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ABSTRACT

This instructor's guide contains three units for teaching gardening and root cellaring in Alaska. The units are intended to be used in long-term gardening projects so students can learn fundamental principles and techniques and apply them to a gardening situation. Each unit contains an overview that provides a basic framework for understanding the unit. In addition, each unit contains more specific background sections, as well as objectives and suggested activities. Annotated bibliographies are provided totalling 39 entries. The appendixes include lists of Alaskan flower and vegetable varieties, addresses, illustrations or diagrams of difficult concepts, and some sample sheets for specific projects. The three units cover basic gardening, gardening in the North, and root cellaring. (KC)

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COLD CLIMATE GARDENING AND ROOT CELLARING IN ALASKA: AN INSTRUCTIONAL GUIDE

by

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Shann Weston

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FORWARD

Pick up a book on gardening, and you are not likely to find more than a passing comment regarding Alaskan gardening. Even an otherwise excellent reference on cold climate or northern gardening omits discussion of Alaskan conditions. This "aura of ignorance" in the popular literature can undermine a gardener's confidence; discouraging experimental methods and stopping the flow of interactive communication the sharing and anecdotes that help establish a gardening tradition.

While there seems to be a proliferation of publications discussing basic gardening techniques, excluding techniques appropriate for northern climates, there is also an obvious lack of information regarding root cellaring. After all, what good does it do to grow produce without appropriate information pertinent to the next logical step--storage? Canning and freezing produce has been a topic well published; however, the alternative of root cellaring, especially in Alaska, has been a topic receiving very little attention. Thus, these units are designed to provide a sequence of study from production through storage. Instruction contained herein is divided into three units: Basic Gardening, Gardening in the North, and Root Cellaring.

It is a fact that successful cold climate gardening requires gardening techniques which have been adapted for use in the north. A positive attitude and a willingness to experiment are perhaps just as important. If we acknowledge we are growing food in a demanding environment, and meet the challenge with innovation and enthusiasm, we have won half the battle. The difference between a gardener or farmer in New England and the counterpart in Alaska, for example, is not so much a major difference in climate as it is a difference in tradition. The Yankee farmer has earned an image of independence and self-reliance in the American consciousness. There is an associated attitude of "can do" in that image that serves to link

contemporary New England gardeners and farmers with a powerful tradition of success in an environment that certainly rivals Alaska for its difficult conditions.

The image of an Alaskan gardener or farmer is far less secure. The Russian missionary gardeners, the Eskimo farmer in Selawik, the Palmer dairy farmer or Delta barley farmer, the Fairbanks gardener, and the village community gardener all represent elements cf the Alaskan agricultural tradition. They are not likely to develop the more homogeneous image of the New England farmer. Because agriculture is relatively new here, it will likely be prone to rapid changes. Alaska's size promotes major regional differences.

However, there is a spirit that can be shaped and shared. Certainly the New England gardener uses the well defined image of "Yankee ingenuity" to a great advantage when he or she turns problems into challenges to be solved. In Alaska, we have lost many legends and traditions to the fast pace of overwhelming changes. We may be able to use this fresh outlook to our own advantage.

It is my hope that out of the character of the land and the people, we may evolve and nurture a spirit of agricultural self-reliance. This spirit would provide the impetus for individual experimentation, while the slowly developing tradition of Alaskan agriculture provides the techniques and varieties that perform well in our northern climate. It is an image that already has strong roots. We have the exciting prospect of participating in its maturity. If we can even visualize an uniquely Alaskan style of agriculture, we are well on our way to establishing it.

In the long run, a desire to make the local economy more viable naturally leads toward the local production of food. This desire, for Alaskans, may emerge as it is sifted out of a confusing set of future options and scenarios; this will take some time. In the meantime, we can all become involved in

establishing our own tradition. We can take pride in the fact that our conditions demand more than average knowledge. We can become leaders in innovative gardening. We can share with our neighbors an image of Alaskan agriculture that does not simply imitate temperate climate methods and technology, but is instead one that combines and modifies the best of the "state of the art" in agriculture with special northern techniques. Perhaps, most importantly, we can invoke an image that refuses to give up when we are told it "can't be done here".

UNIT I: BASIC GARDENING

INTRODUCTION

In the course of writing these two instructional units on gardening, I have made the following assumptions: Alaskan gardeners must contend with cold soils, a short growing season, and the probability of summer frosts. Generalized gardening books are so abundant that they may create more confusion than understanding. For instance, popular gardening techniques, such as mulching, are often widely and enthusiastically promoted as the best choice for all gardeners. The authors base this recommendation on their own assumptions that gardeners do not like to weed, which is likely to be accurate, and that the gardeners are working with temperate climate soils. Though, for the purposes of selling the book to the average gardener, such assumptions may be sound; nevertheless, Alaskans are left in the awkward position of being attracted to a technique (such as mulching) but unsure of its applicability in cold soils.

I am also assuming that time and resources may be limited. By summarizing the basics of gardening, discussing the specifics of Alaskan gardening, and introducing some of the "state of the art" methods and concepts, I hope to present a working overview of the facts and possibilities of what can be done here. The resources section will help to direct readers with limited time and/or desire for additional information to the books that appear most applicable to northern conditions. Another major assumption I have made is that I am writing for beginning gardeners or for secondary level teachers in a rural Alaskan situation.

Finally, like all people who write about gardening, I must assume interest and enthusiasm from the reader, as it is impossible to otherwise rationalize the hard work gardening involves. However, I would like to make one qualification on this point. Like good cooks, gardeners are made, not born. A beginning gardener can sometimes feel that the mysteries of gardening, especially in Alaska, where things must be done right to succeed, can only be

unlocked by someone with a "green thumb" or a Ph.D. in subarctic horticulture. As teachers, we owe it to the beginner to make the entry into gardening as easy as possible. Cultivate trust by admitting from the beginning that gardening can, and most often does, involve hard work.

By returning to the comparison of gardening and cooking, we know that a gourmet cook, as a rule, evolves toward the gourmet level only after the basics of cooking have been mastered thoroughly. Unfortunately, too many authors of gardening books and publications fail to recognize this same learning sequence in gardeners. The result is an abundance of many over-simplified books for novices, or conversely, the highly detailed texts written for "gourmet" level enthusiasts. Few texts are available to foster the transition from novice to gourmet. Somewhere along the line a quantum leap is assumed to have occurred. From what I have observed, the "quantum leap" is, in fact, a time of trial and error, often accompanied by frustration, wasted effort and confusion. The gardener is left to sift an overwhelming hodge podge of seemingly unrelated information and attempt to apply it in whatever way possible.

The high school teacher who is attempting to effectively teach gardening, or using a garden as a biology lab, cannot afford this middle time. Gardening must be taught as a process, not a package. Keep it simple to begin with, then add the layers. Beware of making rototilling indispensable to gardening or ignoring local materials that can be used as fertilizer or soil amendments. Make gardening an accessible, personal experience; one that can be had, on some level, by anyone who wants it.

It may take considerable time and commitment to develop local interest in gardening. If interest and enthusiasm are slow in coming from the students, plant a showcase garden. The garden should be kept small enough so that it can be maintained into the summer, when gardening enthusiasm can generally be counted on to wane and give way to other activities.

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Spend some thoughtful time planning the garden. Stock it with popular vegetables (recommended varieties only!) that are most likely to succeed. Anyone caught admiring the garden or asking questions should be given some produce. By the next year there should be a few interested gardeners. Let success light the fires of enthusiasm. One healthy, delicious home raised cabbage can be far more inspiring to a would-be gardener than even the best of books and class lessons.

HOW TO USE THE GARDENING UNITS

The goal of this instructional guide is to help structure a long term class project in gardening which provides maximum flexibility for the teachers. It is geared toward teaching fundamental principles and techniques, so that students can later apply understanding and skills to any gardening situation they encounter. Units are, by necessity, long term, at least the length of the gardening season. Since learning progresses most rapidly and effectively, by direct involvement (hands-on activities), and by individual problem solving, it is advisable to establish a gardening project that spans two or more seasons. Units are arranged in what the author feels is the most logical order for teaching; however, the sequence may be modified as desired.

Many suggested activities necessitate record keeping. It would be advisable to develop a personal system for maintaining accurate, consistent records prior to the initiation of gardening practices. Scientific and commercial record sheets are not likely to be the best choice for an educational garden project in a classroom setting. Simplified record sheets, such as the sample included in the appendix, can be used as a model for developing a workable individualized system.

This guide is designed to be used as follows:

The overview sections provide a basic framework for understanding the units ahead. In addition, each unit contains more specific background sections, as well as objectives, and suggested activities. The objectives communicate the author's intent for what should be learned by the students for each lesson. The background provides essential information and/or a discussion of methods.

The activities are structured to allow for direct observation and comparison, occasionally to observe the consequences of

proceeding in a manner not recommended. Let the spirit of true experimentation infect the students. Much of what they will be testing has had little or no prior research, especially in the more rural areas of Alaska. They will be, and should come to think of themselves as, pioneers.

The nature of a long term gardening project requires that the students become simultaneously familiar with many inter-dependent concepts. Therefore, a certain degree of overlap in the text is neccesary. To keep this overlap from intruding overly on the instructor's effeciency in using the guide, **it is anticipated that the instructor will first become familiar with the concepts and style of the entire project before beginning individual lessons.**

The resources section (appendix) at the end provides the teacher with miscellaneous helpful material to aid in teaching specific units. It includes an annotated bibliography, lists of Alaskan flower and vegetable varieties, useful addresses, illustrations or diagrams of difficult concepts, and some sample sheets for specific projects. **It is not intended to be a comprehensive materials section**, as it is expected the instructor will supplement information as needed from basic biology or horticultural texts, the reccommended texts given below, and Alaskan publications.

Much of this work will have to be done in the summer. It must be a continuing project, that peaks in activity during the gardening season. Since classes are out for the summer, this should be a priority item to be settled before beginning either unit. It may be possible to teach plant science and many of the basic principles before school lets out. This will allow a natural sequence to continue to use the school's resources to put the lessons into action. Do not rely entirely upon volunteer labor. The success of the projects will depend upon the dedication of the instructor or a paid summer leader. However, do welcome volunteers and give

them specific, satisfying projects to work on. Community support should be actively sought and maintained.

Recommended texts:

There are many useful, well-written books which could be used as references for this instructional guide. The purpose of the annotated bibliography, provided at the end of the gardening units, is to guide the reader to the books best suited for their individual teaching situation. However, there are four books are specifically reccommended as references for all teachers using this unit. They are as follows (see publisher and annotated comments in the bibliography):

Intensive Gardening:

-Bartholemew, Mel. Square Foot Gardening.

General Gardening and Research Methods:

-Levitan, Lois. Improve Your Gardening With Backyard Research.

-Ocone, Lynn. The Youth Gardening Book.

-Raymond, Dick. Joy of Gardening

BASIC GARDENING OVERVIEWS

ESSENTIAL HORTICULTURAL TERMS

It may be helpful to provide the students with a working vocabulary of horticultural terms. This will greatly assist their efforts when selecting garden plants from catalogs and when reading seed packages.

Horticulture:

The term horticulture means "garden culture". Horticultural crops can be trees, fruit, flowers, or vegetables that have a perishable product. They are grown intensively, which means they require careful management, and involve a sizeable investment in labor and capital. A horticultural crop generally has a higher value than an agronomic crop such as grains grown extensively for animal feed.

Annuals, biennials and perennials:

A seed packet will often list a flower or vegetable as being an annual, biennial, or perennial. Knowing what this means is important when deciding what to buy and where to put them in the yard or garden.

Annuals begin their growth in the spring or summer, produce flowers and seeds, and die within one year. Many common vegetables, such as spinach and lettuce, and many flowers are annuals. By carefully choosing varieties suitable for Alaska, a gardener can select for early flowering, a characteristic desirable for flowers and vegetables which produce fruit (such as squash and cucumbers); or to delay flowering and early seed production (bolting), a characteristic desirable for most garden vegetables.

Biennials take two years to complete their growth, requiring a chilling and a dormancy between the first and second year. The first year a non-flowering vegetative growth, called a rosette, grows from the seed. The second year, new growth occurs from the

root and goes on to produce reproductive flowers and seeds. In Alaska, the long photoperiods and cool temperatures sometimes cause biennials such as carrots to bolt, or behave like annuals, producing seed in one season instead of two.

Perennials live for more than two years, and usually have an annual vegetative reproductive cycle. At the end of the growing season, the plant becomes dormant, producing new growth in the spring. In the garden, perennials should be placed in separate beds or on the borders of the garden so that cultivation occurring in other areas of the garden will not interfere with them. Examples include vegetables such as rhubarb, asparagus and flowers such as the delphinium.

Plant classification:

Plants are classified in a hierarchy by families, and then more specifically by the genus and species (just as animals are). There are several major families of vegetables. The curcurbits, or melon family, (Cucurbitaceae) include squash, pumpkins, gourds, watermelons, muskmelons, and cucumbers. The crucifers, also called the mustard family (Cruciferae), includes the genus Brassica which contains the cole crops such as cabbage, kale, broccoli, cauliflower, brussel sprouts, and many root crops such as turnips, rutabagas, and radishes. The Solanaceae family is comprised of potatoes, tomatoes, eggplants and tobacco. In the legume family (Leguminosae) are beans and peas, as well as many field grown crops such as clover and alfalfa. The Umbelliferae family includes parsnips, carrots and celery. The rose family (Rosaceae) is large, and encompasses fruit trees such as the apple, peach, plum and cherry with many flowers and berries like the strawberry and raspberry. Other large plant families also have reprsentatives in the vegetable garden, such as Compositae (lettuce, artichokes), Liliaceae (onions, garlic, asparagus, leeks), and Chenopodiaceae (chard, beets, spinach).

The genus is the main subdivision of a family and is made up of closely related plants. A species is a group of plants which have certain very specific characteristics in common. The genus name is capitalized and always goes before the species name, which is usually not capitalized (unless it is a proper name). Both the genus and species names are underlined or italicized.

The species may be further subdivided into a variety for additional identification. The term for an agricultural variety produced by man is a cultivar. With this classification system, in any language, the common white potato, for example, is Solanum tuberosum. Different cultivars have been selectively developed for qualities such as color, length of growing season, flavor, size, frost hardiness or drought tolerance. Cultivar names often reflect the characteristics for which the plant was bred, such as potatoes ('Alaska Red',' Alaska Frostless'); lettuce ('Crisp-on-Ice'); and peppers ('Park's Whopper', 'Early Prolific', 'Crimson Hot').

Parts of a plant:

The flowering plant has two basic parts: the root and the shoot. The root is a large percentage of the plant. It has three functions: absorption of food and water, storage of food and water, and physical support for the plant. The primary root forms a branching pattern of many smaller secondary roots. With some vegetables, such as the carrot, the portion of the plant consumed is the main root, often called the tap root.

The shoot refers to the stem and leaves of the plant. The vascular (xylem and phloem) system of the stem connects the leaves, the plant's photosynthetic food factories, with the roots, which gather and store water and chemical elements as nutrients from the soil. The major transport networks of the stem are specialized cells. The phloem tissue conducts nutrients. The xylem tissue transports most of the water and minerals. The wide variety of plant shapes and sizes is due to

the structure of the stem. Many horticultural terms describe stem modifications. There are both above-ground forms of stems (crowns, stolons, and spurs) and below-ground forms (bulbs, corms, rhizomes, and tubers). Some plants grow horizontally from the crown instead of vertically. When the stem grows horizontally, along the ground, it is called a stolon. A runner is a very thin stolon. A strawberry plant grows and reproduces by runners.

The onion is a bulb. The bulb is a type of stem surrounded by fleshy structures called scales. The scales of an onion are easily observable. Many flowers such as lilies, tulips, and daffodils are grown from bulbs. A corm is a thickened, swollen stem. Flowers such as crocus and the gladiolus are propagated (reproduced) from corms.

Rhizomes are horizontal underground stems - as distinguished from stolons, which grow above ground. Many grasses are propagated through rhizomes. Potatoes are tubers, the enlarged fleshy portion of a rhizome. Tubers are used by the plant to store starches and sugars. Branches which are horizontal are collectively called offshoots, or may be referred to as offsets, slips, suckers, or pips.

Leaves vary tremendously in size and shape, from "spruce needles" to the edible portions of garden plants such as lettuce and cabbage. What we know as grasses are the leaves of the complete plant.

Photosynthesis and Respiration:

The leaf is the major portion of the plant in which photosynthesis occurs. Some photosynthesis may occur in the stem. Photosynthesis is the process of turning carbon dioxide (a common gas in the air) and water into carbon compounds such as starches. Chlorophyll, which gives plants their green color, is contained in specialized cell structures on the leaves. These structures,

called chloroplasts, captureenergy from sunlight which is used to manufacture sugars and starches from the carbon dioxide and water. Respiration is the process used to break down the sugar and starches to produce energy used by the plant.

The carbon dioxide is passed into the plant through tiny pores on the leaf called stomata. Stomata control the exchange of gases such as carbon dioxide, oxygen, and water vapor. Each leaf has numerous stomata, usually located on the underside. These pores are essential for the plant to accomplish photosynthesis and transpiration.

Stomata can be opened and closed by the plant depending on various environmental conditions. For example, the stomata of the leaf guard against excessive water loss on a hot, dry windy day by closing, so that the water vapor normally lost through transpiration is conserved. On a cool day the stomata will remain open.

Reproduction:

The flower is an important reproductive organ. It may contain both male (stamen) and female (pistil) structures or there may be separate male and female flowers on one plant. In some species, the male and female flowers are on different plants altogether. A perfect flower is one that contains both male and female reproductive structures. Most common garden flowers are perfect flowers.

The stamen produces and discharges the pollen. The pistil contains the ovary. Pollination is the process of transferring pollen from the anther, a part of the stamen, to the stigma, a part of the pistil. Once the pollen has entered the stigma it fertilizes the ovule, or egg. The seed results from this fertilized egg and develops in the ovary, a fleshy protective structure. The fruit of the plant is the mature ovary. In the

botanical sense, all such structures are considered to be fruit, whether they be apples, berries, squash, beans, or nuts.

Plants are often grouped by their usual method of pollination. The transfer of pollen within the same flower or any flower on the same plant is called self-pollination. It is accomplished by gravity or by direct contact of the anther with the stigma. Very few plants rely on self-pollination, although tomatoes, peas, and peppers do produce many healthy seeds in this way.

Cross-pollination refers to the transfer of pollen to a flower on a different plant. It is accomplished by wind, insects, water, and birds. Most plants cross-pollinate, though many can self-pollinate if necessary.

The seed contains the embryo or immature plant. It contains a built in food supply to feed the seedling from the time of germination until it can begin photosynthesis and send down roots. It remains dormant until it receives moisture and warmth in the proper amounts. Some seeds require a period of cold before they can germinate. When the growing season returns, and moisture and warmth are adequate, the seed will swell and break its seed coat.

On some speciesthe first leaves to break the surface are called the cotyledons, also called the first seed leaves, or false leaves. At this stage, many vegetables look very similar. When the true leaves emerge, the seedling has run out of stored food and now requires food.
Directions referring to the first application of fertilizer, or when to transplant seedlings, often refer to the emergence of the first true leaves as the signal to begin.

CHOOSING A GARDEN METHOD

Up to this point, the basics that must be done by any gardener, anywhere, are nearly identical. The next several steps taken will depend upon what was decided during the planning stage. There are two basic choices: the traditional row garden or one of the intensive garden types. However, even a simple row garden can be modified and improved by the use of raised or wide rows. If there is only room or energy for a "postage stamp" size garden, there are still decisions to be made.

Row Gardening:

A row garden is well known to most people. The majority of gardening publications and packets are prepared on the assumption that the row garden method is being used. Therefore, recommendations regarding spacings and dimensions of the garden are based on this method. The major advantage to the row garden in the north is that bare earth will absorb and retain warmth easily. The disadvantages include waste of space and seeds and difficulty in cultivating without a power tiller. Furthermore, major secondary chores after planting, such as thinning and continuous weeding, are required. One of the best references for row gardening in Alaska is published by the Cooperative Extension Service, and is called "16 Easy Steps to Gardening in Alaska".

Intensive Gardening:

If space is short or conditions poor, intensive gardening may be the best choice. The intensive gardening method makes optimal use of the garden area by closely spacing plants together. Growing beds are used instead of rows. The advantages of intensive gardening are many. This method conserves space and seeds, and can be cultivated easily by hand. The preliminary planting time is longer, but other common garden chores, such as thinning and frequent weeding, are significantly reduced.

Northern gardeners should be aware that the "shade mulch" effect (planting crops so close together that they shade out the soil and any weeds attempting to emerge), will also lower soil temperatures. Using raised beds will minimize this effect.

Intensive gardening can be fairly staightforward, as illustrated by the "square foot" technique, a garden based on squares instead of rows (see bibliography for Mel Bartholomew's book, Square Foot Gardening). This method requires that planting be done rather meticulously, placing one seed at a time, rather than broadcasting seeds from a packet. It is a method which requires no mechanization, conserves water, fetilizer and seeds, and is easy to implement.

As confidence and ambition increase, the intricacies of interplanting and equidistant spacing (which treats plants as though they are circles, fitting them very closely together) may become attractive. A complicated garden plan is required for such gardening methods. Furthermore, any style garden can be further modified by using successive plantings with short season crops, or by companion planting, the method based on individual plant "preferences".

A method based on row gardening which uses intensive gardening spacings is the wide row or block garden. This method is fully explained by Dick Raymond in his book, Joy of Gardening. For details on this book and other methods of intensive gardening, see the annotated bibliography.

Do not be overwhelmed by these choices. Remember the layering idea. Try to keep a functional core of gardening principles strongly defined and add the alternatives of gardening methods as layers once the fundamentals are fully understood.

PREPARING THE SEED BED

The best time to prepare new ground or get an established garden ready for spring planting is in the fall. For new ground, cut tall weeds, clear brush and any trees that are too close to this site, and cultivate the soil. For established gardens, the fall is an ideal time to cultivate the soil; it exposes insect pest eggs, it is an excellent time to add organic matter, and it shortens the drying out period in the spring.

Soils vary in content throughout the state. It is advisable to become familiar with the soil in the students' garden. This can be most easily accomplished by using a simple procedure to roughly ascertain soil composition "by feel" (see Lesson 2: Cultivating the Soil, Activity 1, and descriptive sheets in appendix for full information). There are three basic components to soil: clay, silt and sand. Soils with a high silt or clay content should be relatively dry before cultivation, if possible. This is especially important for soil with a high clay content, since cultivation when the soil is wet can destroy soil structure. As a result, the clay particles bind together so that the garden soil becomes composed of irregular sized clods, seriously hindering its germination and drainage qualities.

Most gardens in interior Alaska have a low clay content, but silty soil may still produce undesireable clods from early cultivation. Spring cultivation is always a race with the rapid warming of the season and the desire to get plants into the ground as soon as possible. Unless there is a risk of a greatly shortened growing season as a result,it is usually best to wait until the soil is relatively dry before cultivation (see Lesson 2: Cultivating the Soil, Activity one, for test).

During a cold spring, or when the snow has been unusually heavy, it may be well worth the effort to speed the melting process in any way possible. (Note: Since the following techniques will dry out the soil, use them only when ample water is available for

irrigation or where cold wet conditons in the spring make gardening a marginal endeavor.) For a small garden space, simply shoveling away the spring snow will allow extra time for the soil to thaw and warm. Spreading wood ashes or dirt will cause the snow to melt faster. If using wood ashes, care must be taken to monitor and correct the pH, since the ashes will have the same effect as lime by making the soil more alkaline. Coal ashes are quite high in sulfur and iron, and tend to develop a crust on the surface of the soil, so are generally not recommended for use in the garden.

Refer to the garden plan and evaluate the garden site. Decide what problems are present and how best to remedy them. For example, poor drainage is a common problem in low lying gardens. In cold climates, it is especially essential to improve the drainage since a poorly drained soil is generally cold, severely hindering the growing ability of plants. The best way to improve the drainage of the soil is to add organic matter, which adds nutrients or improves nutrient retaining quailities, warms the soil, and loosens a tightly structured soil. Sand can also be used, but since it is needed in very large amounts to make a difference in drainage, it is best used only for containerized or very small garden spaces.

Garden debris, cultivated into the soil every fall, provides an excellent source of nutrient-rich organic matter. Other than this annual addition, the most generally available source of organic matter in Alaska is peat. Peat should be considered a **soil ammendment**, since it enhances nutrient uptake rather than being itself a source of nutrients. Use peat that is finely ground and well decomposed. Peat is slightly acidic, so care should be taken to keep the pH at acceptable levels (see Lesson 2: Cultivating the Soil).

Sawdust is another excellent source of organic matter, but extra nitrogen must be added to the soil at the same time to foster its decomposition. Native grasses can be utilized for organic matter

as well; either cut early in the season, when young and lush, and used as grass clippings, or later in the season, and used as straw. Vetch or legumes such as Eskimo potato, are rich in nitrogen and would be excellent choices of local sources of organic matter. Fallen leaves can also be used. These materials are best added in the fall and should be well cultivated into the soil. Compost (decomposed organic matter) may be added to the soil at any time.

Another way to add organic matter is to use green manures. These are fast growing cover crops which are cultivated into the soil after being grown to a height of 4 to 6 inches. Rye or clover can be used for this purpose (see the organic gardening bibliography for references if interested in this technique).

UNDERSTANDING pH

Soil testing cannot be done when the ground is frozen or very wet. Unfortunately, in the spring, there is often very little time between "very wet" and just dry enough to plant. The first year a gardener may choose to just fertilize at the recommended levels and test the pH with a simple color comparison soil tester. These are available by mail order or from a garden store for under $10 (see appendix for addresses of mail order garden supply companies).

Testing the pH is another one of the procedures that is always recommended and not always followed. It is worth doing. It can make the difference between large healthy plants and weak sickly plants. In some cases, an uncorrected pH can result in the loss of crops altogether. The reason is simple, and once it is clearly understood the gardener is far less likely to be tempted to skip testing and correcting the soil pH.

The pH value of a soil is based on whether it is acid, neutral, or alkaline. The pH scale ranges from 0 to 14; seven is neutral. Anything from 0 to 6.5 is acid, though for practical purposes, soil is considered to be strongly acid at 5.0. From 7.5 to 14 is alkaline, though, again, soils rarely exceed 9.0. Most vegetables will thrive in a slightly acid soil. For mineral soils, the optimum pH level is 6.0 to 6.5; for organic soils acceptable pH levels can be as low as 5.5.

The reason pH is so critical is that the soil environment has a powerful effect upon the plant's ability to absorb and utilize nutrients. If the pH is too low (acid) or too high (alkaline), the absorption of nitrogen (an essential nutrient), for example, is drastically reduced. It is a valuable exercise to take the time to look at the standard bar graph of soil-reaction influence on the availability of plant nutrients (see appendix). If a picture is worth a thousand words, this simple illustration will

be the best way to understand the importance of the correct pH. A pH of 6.5 is recommended for vegetable gardens because the plant nutrients are all available at optimum or nearly optimum levels. There are a few exceptions. Some crops, such as blueberries, require an acid soil for the best growth.

Add soil testing to the garden chores in the fall. If it is a very busy time, just scoop up some soil before freeze-up as explained in the testing directions (see the Cooperative Extension publication on soil testing, included in the appendix) and let it air dry. Sometime before the beginning of the next season, send it to a soil testing lab (see under general references in the appendix).

Agricultural limestone is most commonly used to sweeten an acid soil. Wood ashes can also be used at the rate of two times the recommendations for lime, and must be immediately worked into the soil to prevent leaching. Peat and sulfur compounds are recommended to make an alkaline soil more acid.

IDENTIFYING AND CONTROLLING INSECT PESTS

In interior Alaskan gardens, there are two insect pests of major importance: root maggots and cutworms. They are most likely to affect the cole and root crops.

Cutworms are the grey, brown and black caterpillars of night flying moths. They cut off young, tender transplants just above or below ground level. Cutworms are a problem only in the spring. They do their damage at night, emerging from the soil to sever the stems of the young plants.

Root maggots are the larvae of a type of fly. The varieties of root maggots that affect Alaska are the turnip maggot and the seed corn maggot. Root maggot flies are active as egg laying adults in June. Their eggs will be laid on the stem of the plant or the soil surface. Eggs hatch seven to ten days after being laid, during most of June. The larvae migrate down the stem and feed on the root tissue. In mid-to late-summer the larvae move out of the root tissue and into the soil.

The result of the larval migration is surface scars and feeding tunnels on root crops. Lightly damaged crops may still be used for home consumption after the damaged portions are cut off. The root system of the cole crops may be slightly or severely damaged. The plant will wilt in proportion to the damage done and may stop growing. In very severe cases, the plant will die. For more information on root maggots, refer to the Cooperative Extension publication "Root Maggots in Alaskan Home Gardens".

An effective measure against cutworms is to place a cardboard collar around the stems so that it is about one inch below and two inches above the ground. Remove collars after plants begin to form heads. Tarpaper or cardboard discs, approximately 4 inches in diameter, may be used to control root maggots on cabbage, cauliflower and other leafy cole crops, but not root

crops. The disc should fit firmly around the stem and rest on the soil surface. It inhibits the deposition of eggs and the migration of larvae into the soil.

The turnip beetle can also be a devastating pest in some gardens. At the beginning on the gardens season, the larvae emerges, resembling a fat, short worm, brownish black in color. This larvae is a voracious leaf eater, primarily affecting the cole crops and carrots.

Following some of the standard prevention guidelines for diseases will also help keep insect pest problems to a minimum: Rotate crops, destroy infected plants, and always buy the healthiest looking transplants available. Fall cultivation, by disturbing life cycles, is very successful at keeping insect populations down. Since cole crops are the most likely to be infested with cutworms and turnip beetles, remove and destroy the crop residue before fall cultivation.

Diazinon, a short-lived (breaks down quickly) insecticide, is recommended for cutworms, root maggots, and turnip beetles if other measures fail. It has a low toxicity to mammals but can kill fish and beneficial insects. Therefore, it must be used very carefully. If Diazinon is chosen as a method of insect control, read the label carefully for directions or consult the Cooperative Extension Service. A local nursery can also supply this kind of information.

BASIC GARDENING LESSONS AND ACTIVITIES

Lesson 1: PLANNING THE GARDEN

OBJECTIVE:

Students will be able to discuss the importance of garden planning and prepare a garden plan for several different kinds of gardens.

BACKGROUND:

Garden planning is essential. It should be the first step of the gardening process. A garden without a plan is like a building without a blueprint. The plants will grow, but not necessarily to the gardener's best advantage. Plan your garden early, while snow is still on the ground.

There is likely to be more available time and interest in the spring; when people are anxious for fresh food and have not yet dispersed to other summer activities. Direct all that energy into planning and planting a really superior small or medium size garden instead of clearing a lot of land that will just become choked with weeds. Do not lose sight of the fact that gardening is a summer long activity. Plan for the harvest. Deciding what to grow should be based on what the gardeners like to eat.

Location is critical. Northern gardens need full sun to be really successful. In Alaska, a gentle southern slope has ideal exposure and drainage. However, there is much that can be done with a less ideal site. Clearing brush and trees must be considered as time factors in garden planning. How is the drainage in the garden site? If it is extremely wet, the soil will be cold and poorly aerated. No garden can thrive on swampy ground. Drainage should be assessed and improved if necessary. In a very poor site, drainage will be improved only by hauling in sand or organic matter, trenching around the garden or constructing raised beds (see annotated bibliography for best resources).

To decide where to locate the garden, assess its function. Will it be primarily to provide fresh greens? If so, keep it small and close to the house. Is it to provide vegetables for storage and processing? Plant a mixture of early, mid- and late-season varieties so processing can be done all during the summer. Planning to be away at fish camp or on vacation? If so, look into mulching as a means of conserving moisture and controlling weeds or arrange to co-garden with a friend. Planting the garden with slow growing late vegetables, hardy to frost, and resistant to bolting (going to seed), for example, creates a very low maintenance situation.

After conceptualizing the harvest, plan the layout. Draw the garden to scale on graph paper. Determine how many of each type of plant it will take to serve the identified needs. Carefully plot each plant onto the paper garden. Usually, the spacing requirements and yield information (for row gardens) for each type of vegetable can be found on the back of the seed packets. Intensive gardeners will need to refer to a resource book on intensive gardening techniques for specific spacing recommendations (see bibliography). Visualize the garden as it will look in mid-July. For example, do not put the carrots where they will be shaded by the turnips. Many of the gardening books listed in the bibliography have diagrams of garden layouts. Use them as a guide for the garden plan.

SUGGESTED ACTIVITIES:

1) Have each student plan a garden. Begin by listing favorite vegetables. Make a separate list of new ones to try.

2) List summer activities which may conflict with gardening, i.e., fish camps, hunting trips, seasonal work, etc.

3) Have each student estimate how much garden produce their family will need for a year. List under three headings: fresh, cold storage, processed (frozen, dried, canned).

4) Check to see which vegetables grow best in the local climate. Determine which climate zone it is in. A good reference for this activity is the Tanana Chiefs Conference Alaskan Gardener's Almanac.

5) Develop a poster with the basics needed for a garden: sun, water, and soil. Ask the students to sketch their house and surrounding land. They can then decide where to locate the garden. Make sure the garden has as much sun as possible, is in a convenient location, and is accessible to water. Make a list of potential problems which may occur locally, such as swampy ground, excessive shading or exposure to wind. The solutions may simply require a windbreak or clearing ground or they may be more complicated, such as correcting wet soil (see Lesson 2 for specific remedies).

6) Make a long range garden plan for the class project. Be careful not to allow the garden to become too large, especially if these are first time gardeners, or if there are problems with too much shade or swampy ground. The garden can be small the first year and be enlarged thereafter. If desired, two different types of gardens can be planned: fresh and storage. A special herb or perennial section may be included, as well. The garden plan will help schedule

activities so that the garden can be improved gradually by adding organic matter to facilitate drainage.

7) Analyze the specifics. For example:
   a) Decide how to remedy conflicts with summer activities. For example, plant late varieties if you expect to be away during the summer. Use mulch to conserve water.
   b) List each student's favorite vegetables. Compare this list to produce that is recommeded for your local climate. Make a new list, with the majority of the vegetables being those that are likely to be successfully grown. Include a few marginal crops, such as tomatoes or peppers which require special attention. (The highest priced vegetables from this category shouldhave the first priority, since they will produce the best value for the effort involved.)
   c) Decide how much time is available for gardening. Use this to determine the size and scope.

8) Draw a garden plan to scale on graph paper. Research spacing required for each type of produce to be planted. Take this time to compare several garden plans such as those in the appendix of this instructional guide. If space is very tight or if some of the students would like to work with alternative methods of planting, take this time to research intensive gardening methods (see bibliography).

9) Expect and calculate a 10% loss in the final harvest for germination & harvesting losses (may be higher for first time gardeners or for adverse conditions).

10) List what the final selections of vegetables will be and how they will be processed.

Lesson 2: CULTIVATING THE SOIL

OBJECTIVE:

Students will be able to: 1) describe several methods of correcting drainage and soil temperature problems; and 2) identify the best methods and substances needed to improve the soil on the garden site, such as the addition of organic matter.

BACKGROUND:

Cultivation is the process of turning the soil under to a depth of six to eight inches so that it is smooth, granular, and ready for planting. Soil is usually cultivated in the fall by turning under the garden debris and adding organic matter. In the spring, cultivation is necessary again just prior to setting the seeds in the soil to provide a quality seed bed and to keep weeds from getting a head start on the garden crops.

Using a rototiller for this purpose is excellent; however, avoid having the students think that a rototiller is indispensable. Such a notion places heavy dependence on a machine that is expensive and requires fuel, maintenance, and repairs. There are many ways to cultivate a garden without a rototiller; however manual cultivation generally dictates that a smaller space be gardened (unless there are plenty of hand tools and willing backs). Sometimes, as an alternative, containerized or intensive gardening techniques may be applied. Emphasize the principles of gardening, which can be the foundation for any style of growing food. Consider the lack of rototiller as a challenge, not a handicap. If the smaller garden enterprise is a success, then consider purchasing a rototiller.

SUGGESTED ACTIVITIES:

1) Determine what kind of soil is in the garden by using the "feel" method. See information sheet on determining soil texture in the appendix for full information. Rub some wet soil between the thumb and fingers. A soil with a high clay content will feel slick and develop a continous ribbon when pressed. A soil high in sand will have a gritty feel; whereas silty soils have a slightly plastic, sticky feel when wet, and a powdery feel when dry. Soils high in silt and clay will tend to develop clods after cultivation; clay clods are very hard and cannot be easily crumbled, silt clods can be more easily crumbled.
   a) If it is determined that the soil has a high clay content, it should not be cultivated until it is fairly dry. To check, use the following standard test: squeeze some garden soil in your hand; if the soil sticks tightly into a ball, it is too wet; if it breaks apart when tapped lightly, it is ready to cultivate.

2) Accelerate soil warming, if necessary, on cold wet sites. Clear some ground specifically for this experiment or section off parts of the garden space. Check the moisture content and temperature of the soil before and after each exercise.
   a) Accelerate the spring melting process by shoveling snow and spreading ashes. Removing the snow cover will significantly lower the moisture content of the soil, therefore this activity should be done only if there is ample water for irrigation, and only if the site is sufficiently wet to warrant the procedure. After the ground is thawed, take the pH of the soil and compare it with neighboring ground to see what effect the ashes had. Record how many growing days were gained or lost by this process.

b) If a rototiller is available, use the high gear to lightly break the surface of the soil. Record how many growing days were gained or lost by this process.

3) Introduce the concept and process of cultivation and compare methods that use equipment such as a rototiller, shovel, plow, tractor and hilling machine. If a rototiller is available, try to arrange a demonstration of its proper and safe use and general maintenance.

4) If the garden requires basic drainage, try the methods listed below. Divide the garden or part of the garden into several smaller sections. Keep one area as the control; do not alter it. Experiment with different methods of improving soil drainage on each section and compare to see what works best for the site. When planting, be sure to use the same crop and the same amount of fertilizer for all experiments. It may be most useful to demonstrate by using a plant which prefers a warm soil temperature, such as zucchini or tomatoes. Try one or more of the following:

a) Add organic matter, such as peat, compost, leaves, or grass, to the garden. Use several different types as a comparison. Turn into the soil and leave fallow (unplanted) until the following spring. After planting, keep track of the effect of soil temperature on plant growth. Note differences in drainage following a hard rain. Take a pH reading before adding the organic matter and later, after planting, to observe changes. The pH will change depending on the type of organic matter added.

b) Dig a trench around each garden section and/or a series of small trenches between the rows. Compare production efficiency, soil temperature, and effectiveness of drainage.

c) Use raised rows in one section of the garden. Wide rows are better for this purpose than narrow rows.

Compare production efficiency, soil temperature, and effectiveness of drainage.

d) Add sand. Note changes in soil texture and drainage. Compare production efficiency, soil temperature, and effectiveness of drainage.

e) Demonstrate the green manure method of adding organic matter; plant a fast growing crop such as rye or clover. While the crop is still lush and green (about three inches tall), cultivate it into the soil thoroughly. Keep track of how long it takes to decompose. Compare production efficiency, soil temperature, and effectiveness of drainage.

Lesson 3: UNDERSTANDING PLANT NUTRITION

OBJECTIVE:

Students will be able to apply principles of plant nutrition to their garden management plan.

BACKGROUND:

There are 16 chemical elements known to be essential for plant growth. Oxygen, hydrogen and carbon come from air and water. The remaining 13 come from the natural soil and/or the addition of fertilizer.

Plant nutrients can be grouped into two categories: primary and secondary. Primary nutrients are needed by plants in large amounts. The most important of these elements are nitrogen (N), phosphorous (P), and potassium (K). For practical purposes, these three elements are essential and, therefore, usually grouped together; thus, the abbreviation, N-P-K, is common.

Nitrogen (N) is available primarily from the organic matter in the soil. Alaska's young soils, because they are often low in decayed organic material, are low in nitrogen. This is an extremely important nutrient. Adding nitrogen to the soil increases growth, yield, and protein values of the produce.

Because plants cannot utilize atmospheric nitrogen, it must be absorbed in the form of ammonium, nitrite and nitrate. Soil microbes are responsible for nitrogen mineralization, the decompositon of organic matter and the release of inorganic nitrogen compounds, which provides most of the nitrogen available to plants. Commercial nitrogen fertilizer is made by a process which uses natural gas to obtain nitrogen from the air. Organic sources of nitrogen include manure, bloodmeal, alfalfa meal and compost.

Phosphorous (P) also aids in rapid plant growth and in making crops more resistant to disease. Commercial phosphorous fertilizer is mined from phosphate rock. Organic sources are manure, bonemeal and compost.

Potassium (K), usually referred to as potash (potassium plus oxygen), is also important for promoting growth and disease resistance. Organic sources are dried fish scraps, manures, and compost. These contain potassium but rarely in sufficient quantity. Wood ashes contain potassium, but caution must be used not to raise the pH too severely. "Greensand", a natural product from the sea, is a good source of potash, but it may be expensive and hard to find. Mined potash is made into a commercial fertilizer. It may be found in garden stores labeled sulfate of potash or ammonium sulfate.

These three nutrients must be either added together or have one or more already present in the soil, otherwise their benefits will be reduced. One of the most important principles in crop production is the law of "limiting factors". This law states that plant growth will be limited by the nutrient which is present in the smallest quantity (see appendix for illustration).

The secondary plant nutrients are magnesium, calcium, and sulfur. If lime is used on the garden, it will supply magnesium and calcium. Sulfur can be bought as a commercial fertilizer or obtained by using compost.

Micronutrients are nutrients required by plants in very small quantities. They are: manganese, copper, chlorine, molybdenum, zinc, boron, and iron. Most fertile soils have sufficient quantities of these nutrients for plant growth. Some Alaskan soils have been found to have boron and molybdenum deficiencies. Refer to the Cooperative Extension publication, "16 Easy Steps to Gardening in Alaska" for directions on how to correct these deficiencies and how best to apply N-P-K fertilizer for Alaskan conditions.

SUGGESTED ACTIVITIES:

1) Illustrate plant nutrition. Use a general plant science textbook as a reference. Make a chart of food for plants, showing the three major nutrients, N-P-K; include what the nutrients do. Add the secondary nutrients to the chart, in smaller letters. Finally, add the micronutrients in the smallest letters.

   a) Compare the big three, N-P-K, with a human nutrition chart. Of the four food groups, protein, fat, and carbohydrates can be easily compared as similar basic building blocks of human life. The secondary and micro nutrients can be compared to other necessary human nutrients such as minerals and vitamins.

2) Use an illustration of a barrel with a short stave to demonstrate the law of limiting factors (see appendix).

3) Review the water and nitrogen cycles. If combining a gardening project with a basic biology unit, this is a good time to discuss the effect of these natural cycles. In addition, discuss where minerals come from, and show how plants get their food from the soil and air. Most general biology texts will serve as a good resource for this activity.

Lesson 4: UNDERSTANDING FERTILIZER

OBJECTIVE:

Students will be able to apply the principles of fertilization to the proper use of fertilizer in the garden.

BACKGROUND:

To find out how much N-P-K a fertilizer contains, check on the bag or in the catalog under "Analysis". Nitrogen is always listed as N. Phosphorous will be listed as P_2O_5. Potash or potassium will be listed as K_2O. They will be listed as a series of three numbers, such as 10-20-20, 8-32-16 or 5-10-10. These numbers always refer to the percentage of N-P-K, in that order. For example, 8-32-16 means 8 percent nitrogen, 32 percent P_2O_5 and 16 percent K_2O. (To convert percent P_2O_5 to percent P, multiply by 0.437, i.e. 32(.437). To convert percent K_2O to percent K, multiply by 0.83, i.e., 16(.83).)

Many gardeners have a difficult time deciding whether to use organic or commercial forms of fertilizer. Unless there is a strict preference, the most sensible approach is to let price be the guide. When seaweed, manure, marine shell or fish wastes are readily available, it makes sense to use them. Since it is very difficult to quantify the amount of fertilizer available to plants using such sources, organic gardening success generally evolves from a trial and error approach. Most organic fertilizers are not complete fertilizers (i.e., they do not contain all three elements, N-P-K.) and must be handled as seperate additions to the soil. First-time gardeners may find it easiest to utilize organic sources conservatively, supplementing a regular N-P-K fertilizer program. As gardeners become more familiar with their local materials and their effects on the garden, a more substantial organic fertilizer program can be gradually undertaken. (Instructors may wish to purchase one

of the organic gardening references listed in the organic gardening bibliography to study while teaching this gardening project. Such an approach affords ample time to seek out local resources and become familiar with how to use them in an organic gardening project to follow this basic gardening unit.)

Before using various type of fertilizer, it is important to understand how each works. In order for a plant to absorb a nutrient it must be broken down into a soluble form. When natural materials are used for fertilizer, they will release nutrients slowly, over a prolonged period of time. Most of them, applied in moderate amounts, will not burn plants on contact. Synthetic fertilizers are already in a soluble form, so their nutrients are quickly and readily available to plants. Because they are so potent, synthetic nitrogen and potash can burn plants on contact and must be thoroughly worked into the soil prior to planting. Roots can be burned too, so be sure not to concentrate fertilizer just below the roots without a covering of soil.

Organic fertilizers are slow to break down and release their nutrients in cold soils. Initially, it may be most encouraging to the students if their plants get off to a fast start. To do so, use a starter liquid fertilizer high in phosporus, and fertilize before spring cultivation with the recommended commercial fertilizer. In the meantime, begin the process of building a compost pile and researching local materials that can be used as natural fertilizers.

Decomposition of organic matter is important. Fresh manure has a high concentration of urine, which can burn plants on contact. It is normally added during fall cultivation so it can decompose before the next planting season. The microbes that decompose fresh organic matter require nitrogen. They will compete for nitrogen from the soil, temporarily depleting it. As decomposition proceeds, nitrogen is released back into the soil. As a result, a garden could have a nitrogen shortage in the

spring, just when it is most needed. Near the end of the summer, when a large amount of nitrogen is suddenly available, the plants will put on rapid leafy growth when they should be maturing.

If a strong interest in strict organic gardening develops, there are some excellent books on the subject (see annotated bibliography on organic gardening).

SUGGESTED ACTIVITIES:

1) Start a compost pile. If possible, start several; each different in content or shape. For instance, a compost:
   a) high in nitrogen materials (young, lush grasses, manure, alfalfa or blood meal).
   b) high in carbon materials (older grasses, newspaper, straw).
   c) made at the proper ratio, with soil added (see compost information sheets in appendix).
   d) made one each in a bin, a barrel, and a pile.

2) Demonstrate commercial fertilizer's ability to burn. Use herbs or houseplants. Fertilize one plant directly under the roots. Fertilize one plants correctly. Compare the results.
   a) Use another plant to demonstrate with soluble fertilizer. Allow fertilizer to splash onto the leaves, expose to a high level of sunlight. Observe and record the results.

3) Demonstrate the enormous weed generating capacity of fresh manure. "Plant" some fresh livestock manure, if available, (mix fresh manure with a bare patch of soil). Compare weed seed growth to a control site.

4) Investigate and list local sources of organic fertilizer. Be sure to identify the main nutrient supplied by each type of fertilizer.

Lesson 5: FERTILIZING AND WATERING THE GARDEN

OBJECTIVE:

Students will understand the methods of feeding and watering the garden and be able to apply the principles to various gardening situations.

BACKGROUND:

The standard recommended amount of commercial fertilizer for gardens is three pounds per 100 square feet. First time gardens will generally profit from a slightly higher rate. Fertilizer can be broadcast by hand, or by a simple spreader available at garden stores. For gardens in southcentral Alaska, 8-32-16 is the fertilizer analysis most often recommended. Interior soils are naturally higher in phosphorus, doing well on an fertilizer analysis of 10-20-20 or 10-20-20. The fertilizer application should be as even as possible. Broadcast fertilizer should be cultivated into the soil before the seed bed is prepared.

If fertilizer is scarce, it may be advisable to band along the rows. This method uses only one-half of the amount of fertilizer. A furrow is opened two to three inches from the seed and runs parallel to the row. The fertilizer rate for banding is one pound per 30 linear feet.

Side dressing can give plants a boost in midseason. It is useful for the cole crops (cabbage family), as well as corn, squash, onions, peppers, potatoes, and tomatoes. Never side dress before the heads begin to form or the first blossoms appear. Early side dressing will cause luxuriant growth but delayed fruit set or head formation. Corn and onions are heavy feeders and can be side dressed frequently.

Do not over feed when side dressing. This will have the same effect as early side dressing. One tablespoon of 5-10-10 or half a tablespoon of 10-20-20 sprinkled in a circular furrow five to six inches away from the stem around the plant is sufficient. Cover the fertilizer to be sure it does not splash up during rain and subsequently burn the plants.

Soluble fertilizer is fertilizer that is dissolved in water before adding to the soil. This kind of fertilizer is used for transplants and can be used periodically throughout the summer on containerized gardens and individual plants. An analysis with a high phosphorus percentage, such as 15-30-15, will keep the plants from developing too much green growth from the nitrogen, and promote a vigorous root system.

Soaking fish entrails and parts in water for several days produces a good homemade soluble fertilizer. The resulting "tea" is an excellent fertilizer; however, since it is high in nitrogen it should not be used as a starter solution, and should be used sparingly late in the season.

There are only two basic rules for watering. The first is to water deep. A garden should receive the equivalent of one inch of rain per week. This will soak the soil to a depth of three to six inches below the surface. Deep watering promotes deep roots. A shallow sprinkling is either lost in evaporation or promotes shallow rooting which leaves the plants vulnerable to drought. A 12 x 15 garden will require 120 gallons of water to equal one inch of rain, or 60 gallons per 100 square feet. This is a good incentive to consider water conservation techniques during garden planting.

The second rule is to water in the early morning or late evening. Watering in the heat of the day is wasteful because most of the moisture will be evaporated.

To conserve water, drip irrigation or soaker hoses, which deliver water directly to the plant's roots, are worth considering as an investment for a permanent garden with the proper facilities. If such an investment does not make economical sense, consider intensive gardening or wide row planting, methods which crowd plants close together and leave little open soil exposed. This concentrates the watering on the crops only, not on the weeds. Dig a small trough around each transplant as soon as it is put into the soil. Water will be held around the plant and allowed to soak down to the roots. Keep the soil around the plants loose and open so the water does not run off. A soil rich in organic matter and free of weeds will hold plenty of moisture.

SUGGESTED ACTIVITIES:

1) Do a simple comparison of the effects of fertilizer. Mark off small sections in the garden: Fertilize one section at the recommended rate, one at double the recommended rate, and one not at all. Plant all sections with a cole crop, tomatoes or squash to best compare the emergence of flowers or heads in relation to the amount of fertilizer. Keep records of height, number of leaves and date of head or flowers emergence and maturity.

2) Side dress two tomato plants in different stages of their development. Side dress one before the first blossoms appear. Side dress the other after the first blossoms appear or when the first green tomatoes appear. Keep another tomato plant as a control (i.e. do not side dress it). Compare.

3) Make some fish "tea". Use on a tomato plant. Compare to another tomato plant receiving commercial soluble fertilizer. (Do not use any other type of fertilizer on the tomato plant with fish "tea".)

4) Measure the rain. Use four empty glass jars. They should be the same size and have straight sides. Leave jars outside during a rain for 24 hours. Then pour all the collected water into one jar. Measure the depth with a ruler. The amount of rain fallen is equal to the depth of the water divided by the number of jars. For instance, three inches of water in the jar should be divided by four, which means three-quarters of an inch of rain has fallen.

5) Observe the effects of watering. Use two tomato plants in containers. Water one deeply whenever the soil is dry one inch below the surface (touch the soil, if no soil clings to finger, it is dry). Water the other everyday with a sprinkler spout. Just moisten the surface. On a hot day,

compare what happens. For example, which tomato is the first to wilt?.

6) Observe the effects of fertilizer. Plant or select a small section of lawn. Fertilize in a pattern that spells the name of the village, preferably in a good public relations area. Maintain.

Lesson 6: TRANSPLANTING

OBJECTIVE:

Students will be able to transplant garden materials and compare seedlings grown under varying conditions.

BACKGROUND:

Many crops in Alaska need to be started indoors. (For a complete list, see appendix.) This indoor tending is important to the success of the garden. For the greatest success, there are a few basic principles which must be followed.

The potting soil must be light and well drained. It can be bought as a commercial mixture or mixed by the gardener. A homemade mix often recommended for Alaska is a mixture of one part soil, one part peat, one part sand. Such a mixture will not be sterile and the plants growing in it may be subject to a fungal disease which causes a condition called damping off. This causes seedlings to wilt and die soon after emergence. To sterilize the soil, it must be baked.

Plant the seeds firmly into the moist medium (commercial or home made). Cover the seed with a thin layer of the media. Seeds can be broadcast or drilled (see activities) into flats or planted individually in separate containers. Cover the flat with a plastic bag and place in a warm dark location. Start checking for germination in a couple of days and check every day after that until the first seedlings appear. The plastic will help keep the soil evenly moist during the first crucial days. After the first seedlings emerge, remove the plastic, and put the flat under lights. Keep moist.

Seedlings are delicate and must not be allowed to dry out. They will have to be watered frequently and gently (no heavy downpours from the watering can). They should be placed under fluorescent

lights (grow lights are not necessary) placed no more than six inches away. Expose to light for 12 to 16 hours of light per day. This will encourage stocky transplants. Many people think sunshine provides sufficient quality and duration of light for the seedlings; however, unless a south facing window with long exposure is available, this will not be sufficient in Alaska. It is important not to let the transplants get leggy. **Cool temperatures (about 65 degrees F.) and the use of tepid water** are very important factors for healthy growth. Seedlings should be stocky and vigorous to survive transplanting to the garden.

After the first true leaves have emerged on the seedlings, they must be transplanted to individual cells or containers. After transplanting, begin to fertilize once a week with a houseplant or seed starting fertilizer (high in phosphorous).

The process of getting the seedlings ready to be transplanted into the garden is called hardening off. The young plants have been growing in a protected environment, so they need almost a week to slowly adjust to the rigors of living outside. This time is especially important with Alaska's climatic extremes and long daylight. Young plants are sensitive to temperature fluctuations, sunburn, and windburn. Transplants that are not hardened off will be significantly delayed and may die from desiccation on a hot windy day or an unusually cool night.

To harden off transplants, begin by withholding fertilizer and decreasing water for a week. This will prevent the young plants from being too lush and tender when they are transplanted. Expose them to the sun for an hour for the first day, followed by increasing exposure by two hour increments daily until they are exposed for up to ten hours per day. Be sure they do not dry out. A cold frame makes hardening off very convenient, eliminating the need to carry the flats in and out of a greenhouse or house (see Unit II, Gardening in the North, Lesson 5: Extending the Growing Season, for discussion).

When the transplants are ready to be planted in the garden, lessen the shock by planting late in the day, so they will not be exposed immediately to full sun. A starter solution (a fertilizer high in phosphorous), promotes a good start for the young plants.

To plant, dig a hole, fill generously with the starter solution. Gently tap the transplant out of its container and place in the hole. Push soil firmly around the base of the plant. It is almost impossible to over water at this time, as the newly transplanted roots are very susceptible to dessication. Make sure the soil is very damp for the first several days.

SUGGESTED ACTIVITIES:

1) Sterilize some soil. Place some soil in a baking pan about two inches deep. Place in a preheated oven and leave for 30 to 90 minutes or until the soil temperature reaches 180 degree F. (NOTE: Baking soil often emits an offensive odor.)

2) Compare broadcast and drilling methods. Plant some seeds using each method. Use shallow planting trays for both.
a) To broadcast, smooth soil in flat. Moisten starting mix with tepid water. Broadcast seeds evenly onto the soil surface. Firm the seeds in the soil. Cover seeds with additional starting mix (well moistened) to a depth of three to four times their own diameter.
b) To drill, make shallow furrows in the moistened soil. Sprinkle seeds into the furrow, cover with moist starting mix. The seeds should be firmly tamped down.

3) Compare lighting. Put one tray of transplants under fluorescent lights which are six inches above the plants. Put another tray under lights that are at ceiling level. Put another tray in a window with no supplemental lighting. Keep records regarding the condition of the transplants under these different lighting regimes. For example, record by date, the number of leaves, size of leaves, height, stem diameter, etc.

4) Evaluate the effects of hardening off. Zinnias are particularly sensitive to frost and sunburn if not hardened off. On a sunny day, transplant some zinnia seedlings directly from inside to the garden. Follow the steps for hardening off for another set of zinnias; then transplant outside. Observe what happens. Leaves that turn brown around the edges indicate sunburn. Record which plants flower first and which plants grow the fastest.

5) Build a hardening off cold frame with recycled materials. See Square Foot Gardening, Joy of Gardening, or Successful Cold-Climate Gardening for details.

Lesson 7: MULCHING

OBJECTIVE:

Students will understand the principle of mulching and be able to demonstrate the effects of mulching on northern soils.

BACKGROUND:

A mulch is a covering over the soil. It is used to shade out weeds and to conserve moisture. In the continental United States, organic mulching is also used to cool the soil. Alaskan gardeners do not want to make their soil any colder. However, the other benefits of mulching make it a practice well worth experimentation.

There are two basic categories of mulch: organic and inorganic. An organic mulch consists of material such as straw, hay, leaves, sawdust, or grass clippings. An organic mulch should be applied only after the seedlings are well established. The mulch is spread between and around the plants to a depth of three to six inches. Organic mulches are convenient to use and should be made of whatever material is the least expensive or most available. Their major advantage over inorganic mulches is that at the end of the gardening season they can be incorporated into the soil to add to the organic matter available for the next growing season.

For northern gardeners, organic mulches have three major disadvantages. First, they may require an extra application of nitrogen to keep the microbes from depleting the soil of its natural nitrogen as they decompose the mulch. The second disadvantage is that they keep the soil cool, a condition northern gardeners do not want to foster. If an organic mulch is chosen for its advantages, it should be applied only to cool season crops and then only on moderately to well drained soil. A northern gardener cannot use a permanent mulch because it

prevents the soil from being warmed by the sun in the spring, a must for northern gardens.

The third disadvantage is that mulched plants will freeze more easily than unmulched plants. The soil absorbs and retains the summer's heat. When a summer or early fall frost occurs, the residual ground heat on unmulched soil is released and is often enough to keep plants from freezing. The insulating effect of mulch prevents this heat transfer, causing the plants to be more vulnerable to the air temperature.

Inorganic mulches are materials that are not biodegradable; that is, they will not break down and decompose as rapidly as organic mulches. Needless to say, they cannot be used to enhance the organic matter in the soil.

Black plastic mulch is reccommended for cool season crops as a low maintenance technique that controls weeds and conserves moisture. However, studies at the University of Alaska Agricultural and Forestry Experiment Station have indicated that a clear plastic is superior to black in warming Alaska's very cool soils. A clear plastic mulch creates a greenhouse effect, accelerating plant growth by keeping the roots warm and moist. Therefore, it is an excellent mulch for heat loving plants, such as squash and peppers. It is not effective at preventing weeds and, can, in fact, promote a weed condition that is difficult to effectively control.

To apply plastic mulch, stretch a single layer over the growing beds or garden rows. Edge the plastic under the soil and secure it against the wind. Punch a hole or make a cut in the plastic and plant the seedling. Put a rain slit on both sides of the row between each plant. A large mulched garden will be most easily watered under the mulch with drip irrigation or soaker hose. Most mulched gardens have substantially reduced water requirements for the rest of the season. However, make sure mulch of any kind is applied only after the soil has been well watered.

Plastic has an additional advantage over an organic mulch. It does not provide much of an insulating effect on the soil. Therefore, the residual warmth of the earth is still available to help keep plants from freezing.

SUGGESTED ACTIVITIES:

1) Experiment with local materials to use for mulches. Plant a row of cool weather crops and a row of warm weather crops. Use as many different kinds of mulch as available. Be sure each kind of mulch sufficiently covers the area around the plant to a spacing of several inches beyond its full grown diameter. To compare differences in response, use the same mulches for warm and cool weather crops. Use soil thermometers to keep track of the soil temperature under each mulch. Keep records of various characteristics as each plant grows.

2) Compare mulches on cabbages (cool season plant). Plant cabbage starts with a black plastic mulch, an organic mulch, and no mulch. Be sure to apply mulches after soil has been thoroughly watered and cultivated. Check frequently for soil moisture. Keep track of how often they must be watered. Compare watering and weeding time of mulched to unmulched cabbages. Compare growth. (The mulched cabbages may grow more slowly, but weeding time will be greatly reduced.)

3) Compare mulches on zucchini (heat loving plant). Plant zucchini with a clear plastic mulch. Compare to unmulched zucchini. (The mulched zucchini should grow more quickly and have a larger yield.)

Lesson 8: HARVESTING

OBJECTIVE:

Students will understand and apply general and specific harvesting guidelines.

BACKGROUND:

Harvesting is the gardener's reward for a summer-long labor. In Alaska especially, harvest comes with a rush, as crops mature in the short summer. Suddenly there is an abundance of produce to be picked and consumed, or processed for storage. It is to the gardener's advantage to be prepared, and to make harvesting a frequent gardening activity, rather than leaving it to be a mountainous chore as crops simultaneously ripen.

The most basic harvesting principle is to begin picking early, and to continue to harvest as often as possible. Thinning can yield a harvest, especially with greens. Thinned spinach, chard and lettuce often provide the first salad of the summer. Thinned beet and turnip tops make delicious greens, and the gardener can continue to thin by eating the small beets first, saving the larger ones for storage. Do not make the mistake of waiting for crops to reach maximum size before harvesting. Recognize when crops are ripe (specific guidelines given below) and harvest in sequence to increase the productive period.

Harvest Guidelines:

Beans and peas: Snap off the pods, leaving the stem end of the pod on the plant. Pick when well filled out with seed but before the seeds bulge.

Beets: Use baby beets for summer fresh eating. Harvest beets up to a diameter of three inches (for most varieties).

Broccoli: Cut the terminal stalk (flowering head) when blossom buds are tight. Continue to harvest the lateral florets all summer long.

Brussel Sprouts: Harvest after the first fall frost. Freezing improves the flavor. Break off the lower leaves of plant when sprouts beging to form to increase productivity. Harvest with a twisting motion when sprouts are young and green.

Cabbage: Cut off head from base of leaves when fully firm and filled out. Keep from cracking in wet weather by rotating head one quarter turn, killing some of the feeder roots, and slowing down its growth.

Carrots: Use thinnings in soups or salads. Dig up main crop when carrots are between one half and one and a half inches in diameter. Carrots can be left in the ground for several fall freezes if they are heavily mulched.

Cauliflower: Pick firm solid heads; tie up leaves as head begins to form to reduce exposure to the sun, which will cause discoloration (not necessary with self blanching varieties).

Corn: Pick when ears are fully filled out to the top and when punctured kernels are milky.

Cucumbers and summer squash: Harvest frequently to keep plants in full production. Pick when fruit is well filled out but not overly large.

Greens: Harvest by picking outside leaves or by cutting entire plant, leaving one inch to sprout new growth, which can be harvested repeatedly: chard, endive, lettuce, mustard, spinach. Harvest by picking outside leaves or branches only: celery, collards, kale (pick after frost for best flavor), New Zealand spinach.

Onions: Do not water onions for a week or two before harvest. Pull up when tops have become fairly dry.

Peppers: Cut off, leaving short stem attached, when fruit is firm and fully filled out.

Parsnips: Harvest after frost for best flavor.

Potatoes: Carefully dig new potatoes after blossoms form, taking care not to disturb the main crop. Dig storage potatoes after vines begin to die down. Spread them in a warm, ventilated area away from direct sunlight or florescent lights for 7 days before storing to allow the skins to toughen.

Turnips and rutabagas: Harvest when diameters are about three inches. Trim tops to one inch for storage.

Winter squash: Cut, leaving short stem attached, when skins resist thumbnail penetration. Store in warm (50 to 60 degrees farenheit), relatively dry area.

Tomatoes: Pick when fruit is fully colored. If frost threatens, pick individual fruits when skin is relatively tough and creamy colored to riper indoors, or bring in entire plant and hang to let fruits ripen.

SUGGESTED ACTIVITIES:

1) Harvest chard, endive, lettuce, mustard or spinach by comparative methods. Choose one or more greens for experimenting.
   a) Harvest two or more plants of the same type using the crew cut method of cutting off the entire plant to one inch of the stem. Keep track of how many more harvests are possible of the same plants throughout the summer.
   b) Harvest two or more plants (of the same type as used in the crew cut harvesting method), by pulling the outside leaves only. Keep track of total harvest of each plant by weighing the leaves at each harvest, and comparing the accumulated end harvest.

2) Illustrate the value of thinning. Grow two crops of carrots. Thin one crop as reccommended on the seed package. Do not thin the other. At summer's end, dig up the unthinned carrots to observe what effects crowding has on root crops. Compare size and quality to thinned carrots.

3) Illustrate the value of curing potatoes before storage. Put some of the potato crop directly into storage without curing. Compare storage shelf life and quality to cured potatoes.

UNIT II: GARDENING IN THE NORTH

GARDENING IN THE NORTH OVERVIEW

GARDENING IN THE NORTH

Gardening in Alaska can be compared to maintaining a car in Alaska. Once the basics are understood; that any car needs to have its oil changed and any garden needs fertilizer, the groundwork has been laid for understanding and coping with specific northern peculiarities. Northern drivers fill their cars with extra thin oils and greases, make sure the antifreeze is adequate for extremely low temperatures, put on winter tires, and install circulating heaters and frost shields. Driving and maintaining a car in the north requires attention and energy, but it is not impossible.

With northern gardening, it is crucial to accept the climatic limitations and to develop a routine of garden maintenance and techniques adapted for the north. Summer frosts are always a possibility, even within the short growing season. In many locations of Alaska, summer days are too cool to successfully grow warm season crops, such as squash and tomatoes.

On the other hand, it may be helpful to recognize some advantages to Alaskan gardening. The cool weather crops do very well in Alaska. They are not as likely to succumb to early flowering or to bolt, as they will in areas with very warm summers. Most of them will survive a light frost and some are even improved by frosts (kale, brussel sprouts). Alaska's long cool days promote the accumulation of sugars in vegetables, giving them a sweeter taste than vegetables grown in more moderate climates. Thus far, Alaskan gardeners have fewer problems with garden pests and diseases than do most gardeners in other areas of the country.

Display, describe and thoroughly explain the principles for northern gardening, similar to the way a winter checklist might be compiled for car maintenance. These principles are explained in the "Gardening in the North" lessons.

GARDENING IN THE NORTH LESSONS AND ACTIVITIES

Lesson 1: IDENTIFYING AND SELECTING NORTHERN VARIETIES

OBJECTIVE:

Students will be able to compare and select plant varieties appropriate for use in Alaska.

BACKGROUND:

Long days and cool nights make many common garden varieties unsuitable for production in Alaska. Be careful when reading seed catalogs or ordering nursery stock from other locations in the United States or Canada. The "days to maturity" listed for a particular vegetable assumes optimum growing conditions. Prolonged cool weather can significantly slow the growth of a crop, thus increasing the number of days it takes a crop to mature.

To choose the best varieties for the local area, use the recommended variety list published by the Cooperative Extension Service for each of Alaska's major gardening regions (Southeastern, South Central, and the Interior). The information in this publication is critical to successful gardening in Alaska. Several varieties of each vegetable, with notes on maturity, yield, general quality, and freezing quality are listed. There can be a dramatic difference in production between these recommended varieties and the seeds, pre-planted peat containers or unsuited varieties often available in the spring in department and grocery stores.

To find seed sources appropriate for Alaska, check garden catalogs, consult Alaskan companies, and/or buy transplants from local greenhouses. If there is a desire to experiment with new varieties, check the summary of vegetable variety trials, published by the University of Alaska Agriculture and Forestry Experiment Station, (AFES), to get an idea where to start. When ordering from catalogs, look for a northern seed source and be sure to select early maturing varieties.

Purchasing ornamental or fruit trees for Alaskan conditions must be regarded as an experiment, with some exceptions. Trees may be listed as being "hardy to 30 degrees below". Hardiness is limited more by the growing season than the cold winter temperatures. If the growing season is too short to allow a tree to lose its leaves and harden off, it will not be able to survive even a light frost. The length of the cold season and the dessication the tree experiences during this time are also major limiting factors. For best results, choose varieties from Alaskan nurseries or other nurseries that specialize in cold weather varieties (see nursery list in appendix).

SUGGESTED ACTIVITIES:

1) Compare seed catalogs. Order several different seed catalogs, from all areas of the country. Spend some time going through each to acquaint students with what they offer. Put thumbtacks on a map of the United States where each nursery is located emphasizing those which grow hardy stock, suitable for northern growing conditions.
   a) Have the students arbitrarily choose a list of 10 flowers and vegetables. Compare to a list of flowers and vegetables that do well in Alaska (see appendix). Revise the list based on what crops and flowers are most likely to be successfully grown in Alaska.

2) Learn how to order seeds. Order the "Vegetables and Fruits Recommended Variety List" for your region from the Cooperative Extension Service. Arctic gardeners should write to the Gardening Program of the Maniilaq Association, Nenana Region, Kotzebue, Alaska.
   a) Have each student plan a garden and make a list of varieties to order, based on the recommended variety list. Look to see if the varieties chosen are available in the national seed catalogs.
   b) Order a seed list from Alaskan companies (see appendix).
   c) Have each student develop an order for their garden, using Alaskan and other suitable sources. Be sure to include shipping. Compare costs.

3) Become familiar with local publications. Order the "Summary of Vegetable Variety Trials" from the University of Alaska Agriculture and Forestry Experiment Station.
   a) Decide what varieties to experiment with next year.

Lesson 2: PROMOTING RAPID EMERGENCE

OBJECTIVE:

Students will learn how to apply procedures to accelerate the emergence of the seedlings.

BACKGROUND:

Cold soils delay sprouting, which can lead to rotting of the seed and damp off (rot at the stem of the seedling). A northern gardener cannot afford poor germination and a long lag time between planting and emergence. Give the seeds a head start by providing them with all their essentials as soon as they are put into the ground. They will need heat, light, fertilizer and moisture.

Shallow seeding is essential to rapid emergence. Follow the recommended seeding depths as given by the Cooperative Extension Bulletins, rather than as listed on the seed package. However, seeds planted at a shallow depth in the soil are prone to drying out and must be carefully monitored and kept moist.

Other techniques that encourage rapid emergence are soil warming and soaking and/or pre-sprouting seeds. Clear plastic mulch can be used to warm soil, and pre-sprouting techniques are explained in the following activities section.

SUGGESTED ACTIVITIES:

1) Compare emergence of soaked and unsoaked seeds. Soak pea seeds for 24 hours. Plant at the same time as unsoaked seeds. Compare number of days to emergence.

2) Presprout some seeds. Use seeds such as lettuce or radishes which will sprout rapidly. Sprinkle several seeds on a piece of coffee filter paper or paper towel placed in a shallow dish. Moisten and slip the whole thing into a plastic bag. Seal and keep warm (about 70 degrees F. is optimum). Check the seeds daily. When most have swelled and sprouted their first root, plant them in the garden. Do not worry about placing the roots down, as the seed will correct for this and grow roots down. Do be careful not to break off the root. Cover them with a light material such as vermiculite, sifted compost, or fine soil. Water using a fine mister, and protect them with a plastic covering. Note the number of days to emergence. (They should emerge in just a few days, compared to the much longer time it would take if conventionally planted).

3) Plant corn seeds under clear plastic mulch. Be sure the soil is moist. Compare time to emergence to unmulched corn seeds. If the corn is to be grown, continue the experiment by cutting out a slit and pulling the corn seedling gently up through the plastic mulch. Compare summer growth to the unmulched corn. There should be a dramatic difference. The mulched corn should do much better than the unmulched corn.

Lesson 3: ENCOURAGING RAPID GROWTH

OBJECTIVE:

Students will understand and apply principles of how soil warming and other conditions affect the growth of garden plants. Students will demonstrate techniques prescribed to counteract adverse conditions and, likewise, promote advantageous conditions.

BACKGROUND:

Cold soils are a major obstacle to the Alaskan gardener. Conditions which contribute to a cold soil temperature are soils that are wet, heavy, or high in clay content. Therefore, an important goal of the gardener should be to prepare the soil so it is loose and well drained. Lighten a heavy clay soil with sand or organic matter. Consider using a raised bed gardening technique to remedy chronic drainage problems.

As explained previously, clear plastic mulch will significantly raise the temperature of the soil. This is especially important for warm weather crops such as squash. Organic mulches will cool the soil and, if used at all, should only be applied on cool weather crops.

When possible, use tepid or warm water to water the garden. River, well, or rain water can be warmed by storing for a day in a dark colored barrel.

Avoid transplant shock by using stocky transplants and using correct procedures (see Lesson 6 on Transplanting, Unit I: Basic Gardening). Be sure the transplants have been properly hardened off.

SUGGESTED ACTIVITIES:

1) Measure and compare soil temperatures. Use soil thermometers to measure the differences in soil temperature in raised versus flat beds.

2) Use soil preparation techniques to warm the soil. Tilling the soil several times on a warm day will mix air with the soil. Then lay a sheet of clear plastic over the soil. Use soil thermometers to compare the prepared soil to a non-prepared area.

3) Use mulch to warm the soil. Grow zucchini or tomatoes under clear plastic on raised beds. Compare with the same crops grown with no mulch on flat ground. Compare both vegetative growth and total production (yield) for the summer.

4) Use an organic mulch on a cool weather crop such as broccoli or cabbage. Do not apply the mulch until the seedlings are well established. Take soil temperature readings before and after applying. Compare with the clear plastic mulch technique.

5) Use black plastic mulch as above in #4. Note and compare soil temperatures.

6) Compare water temperatures. Take the temperature of river water as soon as it is scooped up. Leave some to sit in a dark colored container all day. Take the temperature again. Do the same for rain or well water.

Lesson 4: UTILIZING MICROCLIMATES

OBJECTIVE:

Students will understand how a microclimate affects plant growth and be able to apply techniques needed to accelerate growth.

BACKGROUND:

In Alaska, where the ambient air temperature is often marginal for growing crops, working with microclimates can offer the opportunity for greatest success. A microclimate is a very localized climate, created by modifying influences or location.

Place warm season plants close to the south side of buildings. A tree just to the north of a frost sensitive plant can significantly shelter it from a light frost. The phenomenon of microclimates is an excellent chance for the students to observe natural changes and niches in the local environment. A general biology text would be a good reference for this lesson.

A garden located very near a lake will experience slightly warmer temperatures than the general climate. The lake water has a moderating effect on the air temperature, keeping it from freezing as fast. A garden located near a river, however, is influenced by wind and cold flowing water. Therefore, the river microclimate is often colder than the surrounding area.

A microclimate can be created by any natural or man-made shelter. Where there is no significant microclimate, create one. Any attempt to warm the soil or protect against frost is a manipulation of microclimates. Especially good references are Successful Cold-Climate Gardening by Lewis Hill, Square Foot Gardening by Mel Bartholemew, and Getting the Most From Your Garden by the editors of Organic Gardening.

Vegetable plants in northern gardens need as much sun as they can get. Disregard directions that recommend planting in partial or full shade unless they come from Alaskan sources such as an Alaskan nursery, Cooperative Extension Bulletin, or an Alaskan seed company. Some flower plants do require shade, even in the north; check with nursery where purchased (also, see list of shade flowers in appendix).

The best site for a garden is on a gentle south slope. This angle gives the garden the best light and heat advantage. Flat open, well drained land is also excellent for a garden site. Woodsy gardens will foster etiolated, or leggy, crops that often bolt before they produce. Use a long range garden plan to decide how to gradually compensate for, or remove, shading trees.

Avoid (if possible) gardening on top of a hill. Such a garden will often require windbreaks to minimize the cooling effects of the wind. A site at the bottom of a hill will be adversely affected by the draining cold air that flows off the hills and settles into the valleys. In this situation, frost protection will be more important than full sun, as long as the garden gets at least eight hours of unobstructed sunlight a day.

SUGGESTED ACTIVITIES:

1) Explore local microclimates. Use maximum/minimum recording thermometers to discover the microclimates located around school and other parts of the village. Spend some time on this exercise, combining observation of microclimates (changes in vegetation) with recorded temperatures. Help the students learn to spot potential microclimates.

2) Compare lakeside and riverbank temperatures. Use thermometers on several nights (late summer will show the largest difference) to record differences in temperature for lakesides versus riverbanks.

3) Create a sun trap. Use "hay bales" (use local wild grasses, cut with a scythe, bound together) in a U-shape with the open end facing the south. Plant frost sensitive plants inside and compare their growth to the same crop planted outside a sun trap. Cover with plastic and see how long into the fall the crops can be kept alive.

4) Compare plant growth in shade and full sun. Plant seeds from the same package in shade and in full sun. Try more than one kind of flower or vegetable. Try both partial and complete shade. This can be done indoors also, using fluorescent lights as "sun". Plant seeds and grow them to about three inches before moving them into light/shade. Compare results. Experiment with flowers that are especially light or shade sensitive (refer to seed catalog description), to illustrate uses in Alaskan landscaping.

5) Use at least three maximum/minimum thermometers to record the temperature on a cool night at the top, middle and bottom of a hillside. Use this information to illustrate the flow of cold air down a hillside into valleys. Show how trees or buildings would deflect this flow.

Lesson 5: EXTENDING THE GROWING SEASON

OBJECTIVE:

Students will understand the principles of extending the growing season and be able to construct season extending devices.

BACKGROUND:

How much time is invested in extending the season depends on the time and energy the class gardeners want to invest. It is important that they learn not to feel limited only to the frost free season.

Certain practices and techniques can extend the growing season by allowing an early planting in the spring and a late harvest in the fall. It is possible, for instance, to extend the 90 day growing season in the Interior to one that is more than 120 days long.

There are three methods involved in extending the season. The first involves manipulating growing conditions to enhance rapid growth. The second is planting most of the garden with frost hardy crops. The third is to physically cover garden plants to keep the frost from killing or injuring them.

Anything that warms the soil, and thus accelerates emergence and growth, in effect, extends the season by producing a ripe crop quickly. Raised beds and clear plastic mulch, already discussed, perform this function well and are generally recommended for northern gardening.

A common method used by fruit growers in the south, when frost threatens, is to leave water sprinklers on throughout the night until after the morning sun hits the trees or plants. This method requires a great deal of freely available water and would not be suitable for most Alaskan situations.

Alaskan gardeners are extending the season when they plant long season crops such as the cole crops as transplants into their garden. This can be continued all summer with both short and long season plants. Starting plants indoors can involve pre-sprouting seeds or growing the plants under optimum conditions to transplant size before setting them in the garden.

There are many frost hardy vegetables to choose from, though their degree of tolerance to frost differs. All the cole crops, greens, and root crops will endure a light frost. Some vegetables are exceptionally cold hardy such as kale, collards, cabbage, brussel sprouts and turnips. In addition, many flowers that are colorful and easy to grow, such as pansies, will endure repeated frosts. The key is to know which crops to grow. Keep this in mind when planning the garden. Use the appendix to help choose varieties of flowers and vegetables suitable to grow when frosts are likely. Be aware of the frost intolerant crops and plant them in locations or situations that are easy to cover. Also, be advised of the last and first frost date in your area.

Succession planting, especially when using frost hardy crops, is an excellent way to extend the growing season. Take a chance on some plants, if the garden soil is ready, and plant them early. After the traditional planting date, continue to plant at two week intervals until mid-summer for a continuous harvest. If combined with pre-sprouting seeds or starting transplants, this system can be made even more efficient. Late planted crops will usually grow quickly because the soil and days are warm. If frost hardy crops are used, they will continue to grow and ripen into the fall.

When a frost does threaten, remove all ripe produce. Mature-green tomatoes and winter squash can be ripened indoors. There are many systems to physically protect plants from frost. The oldest and easiest is to cover the vegetables when a frost is predicted. Use boxes, quilts, sheets or newspapers. (A thin sheet of plastic will <u>not</u> sufficiently insulate the plants).

Take care not to crush the plants and to remove the coverings promptly when the temperature rises sufficiently, usually by mid-morning. In the late summer or fall, use the residual warmth of the soil by including as much of it as possible under the covering. Root crops, such as carrots, can be protected by using a hoe to hill a covering of soil over the exposed root.

Hot caps are another simple method to protect tender seedlings in the spring. They can be homemade by using plastic or glass containers such as milk jugs placed right side up with the bottoms cut out. Large jars can also be used. Hot caps are made commercially and can be bought at garden stores. One hot cap is used for each seedling, and placed over the plant at night or when cold or very windy conditions are imminent. Be sure to remove them during the day.

Cold frames are frames laid flat on the soil or slightly subterranean. They are then covered with glass or plastic, allowing light to enter and heat to accumulate, thus keeping cold temperatures from killing the plants. The simplest cold frame is any kind of shallow box, minus top and bottom, with a glass pane window frame set on top of it. The best cold frames are angled and face south to make the best use of the sun. Cold frames can be used to shelter or harden off seedlings, to grow warm season crops in the summer, and to continue to grow cold hardy plants into the fall. They are an excellent device for northern gardeners. Their only disadvantage is that they require careful monitoring to make sure the temperature does not get too high. Therefore, this involves attention to opening the glass covering as required to make sure the seedlings do not dry out.

A hotbed is a cold frame with the addition of some kind of bottom heat. This will allow the gardener to set seedlings out even earlier, while snow is still on the ground. The old fashioned way was to use one to two feet of fresh manure (horse or poultry are the "hottest" and, therefore, the most suitable) in the bottom of the hotbed, covered over with about four inches of

soil. The manure will ferment and heat up, providing warmth to the seedlings. The disadvantages to manure are that it may be hard to find in rural Alaska and it is difficult to gauge the optimum amount to use, so that the seedlings are kept warm, without overheating.

The cloche originated in Europe. The first cloches were elaborate glass covered frames which covered an entire row of crops. Modern day cloches accomplish the same function but are usually made of plastic tunnels, supported by wire hoops. They can be homemade, using heavy gauge wire or coat hangers and clear plastic sheeting. There are several commercial types available.

An excellent way to use cloches in Alaska is to combine them with clear plastic mulching. Frost tender plants are planted with this mulch in the usual method, with the plastic tunnel placed over them for additional warmth. When temperatures rise, the tunnels can be folded down halfway and fastened with clothes pins to allow pollination, and keep the heat from building to an undesirable level. When temperatures fall or a cold wind threatens, the tunnels can be pulled up again.

The most elaborate season extender of all is the greenhouse. There are many excellent references on greenhouses that detail how a greenhouse works and how to build a greenhouse. These usually include examples of different kinds of greenhouses. References for use in Alaska are noted in the annotated bibliography of the resources section.

SUGGESTED ACTIVITIES:

1) Compare transplanting dates. Do two plantings of cabbage transplants or another cole crop. Plant one in the early summer. Plant the other early to mid-July.

2) Plant an extended harvest. Plant a few spinach seeds every two weeks until mid-August for an extended harvest.

3) Compare plant varieties for frost tolerance. Plant several varieties of frost hardy and frost intolerant flowers and vegetables (see appendix). In the fall, use a minimum/maximum thermometer to record the temperature that finally kills or seriously injures each type of plant.

4) Use hotcaps to protect plants. Plant some cole crop transplants two weeks before the last frost usual for the local area. Use homemade hotcaps to protect at night.

5) Make a cold frame or a hotbed (see bibliography for references). Use to start seeds early and, in the late summer, to plant cool weather transplants to continue growing into the fall. Potted herbs and flowers which are sensitive to frost can also be placed in the cold frame to extend their growing season.

6) Construct and use plastic tunnels. Plant a row of peppers using plastic tunnels. Compare with peppers planted in the open. Determine which plants get the first, last and most peppers.

ANNOTATED BIBLIOGRAPHY FOR THE GARDENING UNITS

ANNOTATED BIBLIOGRAPHY: GARDENING

Bartholemew, Mel. Square Foot Gardening. Rodale Press, Emmaus, Pennsylvania, 1981.

If you're looking for a simple introduction to intensive gardening, this is the book. Well written, full of diagrams and illustrations, this book could launch you into a whole new approach to gardening. This method conserves space, and because it is so small, is well suited to frost protection, or otherwise maximizing your microclimates. Very highly recommended. Reference for garden plans.

Buckley, Shawn. Sun Up to Sun Down. McGraw-Hill Book Co., New York, 1979.

This book makes the fundamentals of solar technology understandable. Whether you are thinking of building a solar house or greenhouse, or simply wish to gain a better understanding of the concepts, this book will be a big help. It would make an excellent reference for a high school group.

Campbell, Stu. The Mulch Book. Garden Way Publishing, Charlotte, Vermont, 1973.

This book is extremely well done. It encourages a creative approach to the art and science of mulching-an approach much needed in Alaska. With our cold soils we may have limited uses for many of the more common mulches but this book will get you thinking about some possibilities. The discussion of the whys and what's and hows of mulching are straight forward and well-written. Furthermore, this book is written from a New England perspective so we know we have at least some weather in common.

Clegg, Peter and Perry Watkins. The Complete Greenhouse Book. Garden Way Publishing Co., Charlotte, Vermont, 1978.

Highly recommended. This thick book offers very complete coverage of the field, as the title indicates. It begins with an interesting history of the greenhouse, and ends with a fascinating collection of state of the art solar homes with integrated greenhouses. In between are detailed sections on design, construction practices and principles, glazing materials, heat storage, and greenhouse horticulture. The book is full of clear illustrations and highly informative charts on such things as glazing material performance, insulation and plant requirements. The author also provides plenty of reference sources and lists of manufacturers of the various products described.

Craft, Mark ed. Winter Greens: Solar Greenhouses for Cold Climates. Firefly Books Ltd., Scarborough, Ontario, 1983.

Good book; folksy style but with clear, easy to read diagrams. Full directions for building a solar greenhouse and lots of examples of existing Canadian solar greenhouses.

DeKorne, James. The Survival Greenhouse. Peace Press, Culver City, California, 1978.

An interesting title, one that might attract an Alaskan. However, this system is based upon a pit greenhouse, which unless you are blessed with a very favorable location like a southern slope with good soils and no ice lenses, it wouldn't work very well in Alaska. Furthermore, it describes a hydroponic system which depends upon a little ecosystem that includes fish and earthworms. It's an interesting idea and one that might work with some modifications in certain parts of Alaska (The author lives in the New Mexico Mountains). Includes a very good discussion of the concepts behind raising your own food.

Faust, Joan Lee. The New York Times Book of Vegetable Gardening. Quadrangle/The New York Times Book Co., New York, 1975.

This is one of the best all-around reference gardening books. If you're looking for one book to cover the basics of gardening, this is it. It is very complete and covers the fundamentals of planning, planting, growing and caring for a garden in a crisp, well-organized style. It features a color drawing and complete detailed culture outline for 44 vegetables and 12 herbs. This is the kind of book to refer to again and again.

Hays, Wilma and Vernon Hays. Foods the Indians Gave Us. Ives Washburn, New York, 1973.

This is a children's book, written for 6th grade and up. It covers the history of potatoes, peanuts, beans, tomatoes, pineapple, chocolate, cocoa, corn, strawberries, peppers, maple sugar, wild rice, cassava, vanilla, avocadoes, squash, pumpkin, Jerusalem artichokes, sunflower seeds, berries, plums, wild cherries and nuts. Surprised to see so many? All were cultivated by North and South American Indians. It may be worth reviewing and referencing when discussing the development of agriculture; it is important to stress that agriculture is and was not exclusively an Old World phenomenon.

Hill, Lewis. Successful Cold-Climate Gardening. The Stephen Greene Press, Brattleboro, Vermont, 1981.

Excellent reference for beginning and experienced Alaskan gardeners. Written in a personal manner, it makes interesting reading,

full of anecdotes and facts on northern gardening. He makes no mention of Alaskan gardening but his local climate is fully as harsh as many areas in this state; his techniques appear sound.

Kramer, Jack. Your Homemade Greenhouse and How to Build It. Walker and Co., New York, 1975.

This book has lots of pictures and many diagrams on all types of greenhouses. It has a small section on greenhouse conditions and maintenance.

Levitan, Lois. Improve Your Gardening With Backyard Research. Rodale Press, Emmaus, Pennsylvania, 1980.

For teachers, enthusiastic gardeners, and kids that love to design experiments, this book is a must. It begins with defining the experiment, as distinguished from eyeball comparisons and hazy memories. It details how to research background information and how to plan and conduct an experiment. It offers many ideas on what kind of experiments can be done and how to evaluate the results of the research. Well written, well illustrated altogether an outstanding book. (Highly recommended for effective use of these instructional units on gardening and root cellaring.)

Mazria, Edward. The Passive Solar Energy Book. Rodale Press, Emmaus, Pennslyvania, 1979.

Well written and fascinating, this book would be a well-used reference in any solar homebuilder's library. It is written in a way to make the fundamentals clear, then help incorporate a solar design into houses and greenhouses. Though complete and detailed, its specifications are, of course, for the temperate latitudes. Keep this in mind when attempting to incorporate their designs into Alaskan latitudes.

McCullagh, James C. ed. The Solar Greenhouse Book. Rodale Press, Emmaus, Pennslyvania, 1978.

The best single source for complete information. This is not a book thrown together to ride a trend in sales. Nor is it a personal account of one individual's greenhouse experience, as many books with similar comprehensive sounding titles turn out to be. In 328 pages from six contributors, it covers everything from initial design through long term crop management, including: climate control, shape, slope and orientation of the greenhouse, controlling heat loss, covering materials, heat storage, seasonal design criteria, construction, eight sample greenhouses, cold frames, plant growth basics, and crops for the greenhouse. All of it is highly readable and well illustrated with diagrams and photographs. Of particular value to the Alaskan reader is the inclusion of the whys, not just the hows. A thorough explanation

of the principles underlying each design, activity, or decision, allows the reader to judge applicability to his/her own location and needs.

Minnich, Terry. The Rodale Guide to Composting. Rodale Press, Emmaus, Pennsylvania, 1979.

The best guide for those who are serious about composting. Detailed and easy to read, this complete reference is done with the usual high quality Rodale standards.

Newcomb, Duane. The Postage Stamp Garden Book. J.P. Tarcher, Los Angeles, California, 1975.

Once in awhile you come across a book that is both funny and informative, that can tell a good story but back it up with solid facts. This book does that. The author has a drum to beat but he makes no excuses and gets right on explaining why he believes in, and practices, what he terms "Intensive Postage Stamp" (IPS) gardening. He gives an explanation of what intensive gardening is all about, some sample garden plans, then goes through the vegetables separately to examine their suitability to this type of garden. Excellent for anyone with difficult conditions or limited space who wants to get maximum yield from minimum room.

Ocone, Lynn. The Youth Gardening Book. Gardens for All, Burlington, Vermont, 1983.

A complete guide for teachers, parents and youth leaders. Excellent section on the basic challenges inherent in establishing a youth garden and tips for success. Plenty of garden activities for kids and good overview of basic gardening. Highly recommended as a valuable reference.

Organic Gardening editors. Getting the Most From Your Garden. Rodale Press, Emmaus, Pennsylvania, 1980.

This book details advanced intensive gardening techniques. It deals with growing beds, interplanting, companion planting and extending the growing season. Highly recommended for its excellent section on cold frames and other season extending devices. Reference for garden plans.

Ortloff, Stuart H., and Henry Raymore. A Book About Soils for the Home Gardener. William Morsow & Co., New York, 1972.

A mini-textbook, designed for the serious gardener who wants to know the basics of soil science. Well-written and complete, divided into two major sections: soil nature and soil management. Highly recommended for teachers.

Raymond, Dick. Joy of Gardening. Garden Way Inc., Troy, New York, 1982.

Reccommended as a reference for this gardening instructional unit. Excellent, dynamic book; very well laid out, easy to read, full of information. Excellent diagrams and photographs. This book should be a standard in every gardening library. Fully describes Dick Raymond's wide row method of gardening. Good reference for garden plans.

Riotte, Louise. The Secrets of Companion Planting for Successful Gardening. Garden Way Publishing, Charlotte, Vermont, 1975.

Written in an alphabetical format, this book goes through all the common vegetables, and flowers, as well as pests, nutrients, herbs, weeds and trees in relation to what they "like" or "don't like". It is worth looking into, even if you tend to lump companion planting in the same category as astrology. At least some of these plant preferences have been scientifically proven to be a real phenomenon, though the reasons are not always known. Companion planting can include everything from tucking a few bee-attracting flowers around vegetables that require pollination (like squash) to using marigolds to repel nematodes.

Rogers, Marc. Growing and Saving Vegetable Seeds. Garden Way Publishing, Charlotte, Vermont, 1978.

Excellent discussion of the sexual reproduction of plants,and how to select, collect, extract, dry, store and test seeds. Highly recommended for high school teachers who want to use the garden as a lab or gardeners who want to save their own seed.

Scheller, William. Successful Home Greenhouses. Structures Publishing Co., Farmington, Michigan, 1977.

A good reference, especially for landscaping considerations. Quite a few color photographs, black and white photographs and clear diagrams.

Siegchirst, Charles. Building and Using Cold Frames. Garden Way Bulletin A-39, Garden Way Publishing, Charlotte, Vermont, 1980.

A cold frame can shelter plants down to 15 degrees F. with added insulation. That should be enough to get any Alaskan gardener's attention. It is obvious how a cold frame can extend the gardening season. Presents the basics and the design for building a cold frame from scratch.

Wahlfelt, Betty G. All About Greenhouses With 15 Build-Your-Own Plans. Tab Books, Inc., Blue Ridge Summit, Pennsylvania, 1981.

An excellent book, highly recommended to anyone who needs to review several different styles of greenhouses before deciding which to build. Very complete discussion of greenhouse management. Geared toward the do-it-yourself home builder.

ANNOTATED BIBLIOGRAPHY: ORGANIC GARDENING

Bennett, Jennifer. Harrowsmith Northern Gardener. Camden House, Ontario, 1982.

Very good reference for Alaskan gardeners. Strongly oriented toward organic gardening. Good section on extending the garden season. Good section on mail-order sources suitable for the north.

Logsdon, Gene. The Gardener's Guide to Better Soil. Rodale Press, Emmaus, Pennsylvania, 1975.

Excellent discussion of soil science, the importance and function of soil, plant nutrients and soil, all in a gardening perspective. Covers topics such as mulch, compost, fertilizers, green manure and cultivation. Written from an organic gardening perspective.

Ogden, Samuel. Step-by-Step to Organic Vegetable Growing. Rodale Press, Emmaus, Pennsylvania, 1971.

This book was written by another Vermonter, so it has a northern perspective. A good basic book.

Organic Gardening Editors. The Encyclopedia of Organic Gardening. Rodale Press, Emmaus, Pennslyvania, 1978.

Basic reference for a serious organic gardener. Good addition to any gardening library.

Organic Gardening Editors. The Organic Way to Mulching. Rodale Press, Emmaus, Pennslyvania, 1971.

This book gets points for actually having an Alaskan example of mulching. In Wrangell, a man was able to grow superior berries by using a seaweed mulch. A thorough presentation of the mulching methods, what mulch does for soils, and what kinds of mulches to use. There is also a chapter which attempts to discourage the use of plastic mulch, on the basis that it is not biodegradable, wasteful, and does nothing for improving the soil.

Rodale, Robert ed. The Basic Book of Organic Gardening. Ballantine Books, New York, 1971.

Probably the best all-around text on organic gardening: the whys and hows.

Stout, Ruth and Richard Clemence. The Ruth Stout No-Work Garden Book. Rodale Press, Emmaus, Pennsylvania, 1976.

You will have heard of Ruth Stout if you have read up on mulches. She advocates a deep layer of mulch over the whole garden. Because of the continuing decomposition, she does not have to add fertilizers. The mulch also keeps the soil in loose, viable condition so there is no need to cultivate. Before your eyes light up at this remarkable method keep in mind she is doing this in Connecticut. Her permanent mulch would not work with Alaska's cold soils. Still, if you are curious about the lady that made mulching a household word, it makes interesting reading.

EVALUATION OF THE GARDENING INSTRUCTIONAL UNITS

Please take the time to fill out the following evaluation form. Your feedback as a teacher will be used to help revise this guide. Attach additional pages if necessary.

1) Name, address, and phone number:

2) Dates and length of time this guide was used:

3) Previous gardening experience of you and your students:

4) Ages and numbers of students involved in gardening project:

5) Portion of guide that was used:

6) How did this guide aid your gardening project?

7) What can be done to improve this guide?

8) Please discuss your personal experiences in using this guide and list your recommendations and comments for revisions.

9)Did you develop new activities or materials while you were using this unit which you think may be appropriately added when this unit is revised? If so, please describe.

UNIT III: ROOT CELLARING

INTRODUCTION

As with gardening it is difficult to provide a "sure-fired" recipe for successful root cellaring in the North; however, there are many basic concepts and techniques which provide the foundation upon which to make intelligent decisions regarding particular practices and their appropriateness in a northern climate.

This instructional unit is designed to provide the basics of root cellaring. It is not a guide for root cellaring which can be followed in sequential steps. A thorough understanding of the concepts and techniques contained herein is a prerequisite to successfully designing and utilizing a root cellar. Experimentation and analysis will be required to select the techniques which are most appropriate for a given situation. Therefore, many "suggested activities" are provided which allow students an opportunity to compare the various concepts and techniques discussed.

HOW TO USE THE ROOT CELLARING UNIT

Root Cellaring is used as a verb in this instructional guide. It is useful to think of root cellaring as an action process, rather than as a project to be simply completed. The balancing act involved in maintaining optimum levels of temperature, humidity, and ventilation requires innovation and frequent monitoring. Once a successful system is developed, maintenance of the proper variables becomes easier, but it is, by nature, a trial and error process.

Before beginning the root cellaring unit, read the **overviews** carefully. They are intended to provide the instructor with a broad outline of the basics of root cellaring, and of the many techniques and facilities which can be employed or developed for the cold storage of produce. The **background** contains additional specific information for each lesson, and/or a discussion of methods, potential problems, or educational approach. The **activities** are structured to allow for direct observation and comparison, occasionally to observe the consequences of proceeding in a manner not recommended.

The resources section includes an annotated bibliography and an appendix. Root Cellaring, by Mike and Nancy Bubel (see bibliography for details), is highly reccommended as a reference for this instructional guide.

ROOT CELLARING OVERVIEWS

INTRODUCTION TO ROOT CELLARING

The traditional root cellar was an underground storage room for vegetables and fruits. It was either a separate building, built completely or partially into the earth, or built into the corner of the cellar of the house. Once common, root cellars have largely disappeared from the American way of life as freezing and canning have gained in popularity, convenience foods have replaced home raised foods, and house owners have converted drafty cellars into warm, dry basements. The resurgence of interest in gardening, and the resulting seasonal abundance of produce, have promoted a renewed interest in root cellaring to economically store the harvest.

Modern root cellaring is the art and science of preserving fresh foods in cold storage. Suitable storage areas are widely variable, including: the garden, trenches and pits, cold holes, converted basements, cellars, or cool, dark areas of the house.

The goal of root cellaring is to preserve raw, whole vegetables and fruits after their harvest day. Storage in a cold, moist atmosphere slows their natural cycle toward decomposition for up to several months. Produce should not be allowed to freeze.

Root cellars make sense in Alaska. Electricity is often absent or expensive, food is costly and often of poor quality from being shipped for great distances, and the growing season is short but often intensely productive.

Root cellars have many advantages over other methods of food preservation. Once a root cellar is built, or an area properly converted, there is comparatively little work involved in preparing produce for cold storage. Produce is stored whole and unwashed. This is an advantage for northern gardeners, who often find that the garden is at peak productivity at the same time the fall frosts begin.

A root cellar can be built to accommodate the entire season's harvest, and it can absorb produce almost as quickly as it is picked. This large capacity, compared to other methods of preservation, such as canning or freezing, can make growing extra produce for feeding livestock feasible.

Root cellaring is a safe method of food preservation. If food is spoiling, symptoms will be obvious. The decayed portions can be cut away, allowing at least part of the vegetable to be eaten as fresh produce would be, without danger of botulism.

Cold storage of fresh foods has some disadvantages. Storage or shelf life is not as long as that of freezing or canning. Root cellaring conditions should remain constant during the entire time food is stored. In order to accomplish constant cool temperatures, a storage area must be built or an existing structure modified. Careful attention to detail is necessary during the entire storage period. Continuous monitoring must identify the status (i.e., decay) of individual items so each can be eaten in order of their time of harvest or initial storage date. To facilitate this process, post the average keeping time of each kind of produce outside the storage area.

Large scale root cellaring requires planning. An estimate of how much a household will consume should be made to decide how much produce is needed. This should involve garden planning to specify the number and kinds of vegetables that should be stored.

PRINCIPLES OF ROOT CELLARING

There are four primary variables which must be controlled in root cellaring: temperature, humidity and ventilation, and light. Learning what is required for each type of produce, and how to manipulate the levels of each, is the key to successful food storage.

Temperature:

The temperature range of 32 degrees F. to 40 degrees F. slows microorganisms and the natural enzymatic action within the produce which result in overripening and eventual rotting. Low temperatures also slow the respiration rate of the produce. After harvest, vegetables and fruits continue to respire, combining carbohydrates in the cells with oxygen from the air. Water and carbon dioxide are formed and heat energy is released. Without ventilation, the temperature of the root cellar would rapidly rise to detrimental levels.

The amount of heat released varies with the type of produce and what its storage temperature is. An apple will respire more heavily at 65 degrees F. than at 35 degrees F. The shelf life of most storage vegetables is severely reduced at warm temperatures. There are a few exceptions, notably the warm weather crops, such as pumpkins, squash and green tomatoes. These crops keep longest at moderately warm temperatures (50 degrees to 60 degrees F.) and a lower humidity (60 to 70 percent). Onions and garlic store best when cool (40 degrees F. to 55 degrees F.), and relatively dry (50 to 60 percent humidity). These vegetables should be stored separately from the main root cellar (see appendix for details).

Humidity:

High humidity is required to keep most vegetables and fruits from shrinking and losing quality. Produce should be segregated

according to their storage requirements for temperature and humidity. For the majority of root cellar crops,85 to 95 percent humidity is optimal . To monitor the storage areas for humidity levels, use a sling psychometer or a wet bulb/dry bulb hydrometer. These are available for under $150 through nursery and agricultural catalogs, and at some commercial greenhouses.

It may take some time to get humidity levels adjusted correctly without affecting the temperature of the root cellar. In the case of a particularly stubborn problem, it is relatively easy to localize the required humidity by storing produce in plastic bags (punch several quarter-inch holes in them for ventilation) or packing produce in damp sand or sawdust.

Ventilation:

The heat from respiration given off by vegetables should be vented from the storage area before the room temperature increases. Ideally, the way to do this is to vent cold air into the root cellar at floor level,thus exhausting the warm air near the ceiling as it is forced upward by the incoming cold draft. Unfortunately, this can result in a stubborn condensation problem, which worsens as the ambient air temperature gets colder. The resulting damp environment considerably shortens the life of any wood timbers used in the storage facility, a factor which must be considered when choosing between concrete and wood as building materials.

Light:

A root cellar or storage area should be kept dark, especially if potatoes are to be stored. Light causes potatoes to turn green, indicating the presence of the toxic substance, solanine. Cover any windows that might allow light and heat into the stored produce. Keep in mind that fluorescent lights will have almost the same effect as sunlight.

TYPES OF COLD STORAGE

This section gives an introduction to many types of cold storage facilities. Indoor and outdoor facilities are discussed, with references for major projects and details for small scale projects. By reading through this introduction, the reader may become familiar with various methods of cold storage and choose one best suited to the local situation. **This overview provides the essential background for all the lessons.**

Indoor Storage

The classic root cellar, once commonplace, was usually in the corner of the original cellar hole. The masonry foundation and the packed earth floor promoted optimum temperature and humidity. An operable window was used for ventilation. In a house that has a cellar, the cold storage area is essentially made to order, though heating bills may be increased as a result. Select the coolest corner, build two walls to close off the corner, and the root cellar is ready for details such as ventilation, shelving, and maintenance of proper humidity and temperature.

The Modern Basement Storeroom: There are several good publications available that fully describe the details of modifying an area of a basement storeroom for cold storage (see root cellaring bibliography). Just as with the cellar, start with the coolest corner, but in this case the stored produce must be insulated from the warmth of the basement. The commonly recommended minimum amount of floorspace for efficient temperature control is 36 square feet.

A small operable window provides adequate ventilation in a basement root cellar. However, during the winter, take care that the temperature is not critically lowered to the freezing point. A small fan can also be used to ventilate the area. Storage containers can be homemade. Any number of recycled items can be used, such as slatted-wood citrus crates, barrels, baskets, or

cardboard boxes. The best containers are those which allow free ventilation and are easy to clean. Ventilated plastic bags provide a cheap and easy way to store produce.

Attic Storage: If an attic is available with temperatures approximating 55 degrees F., it is possible to store squash and pumpkin there. If a section is partitioned off and insulated so it is cooler, the area can also be used to keep onions and garlic. However, for other produce, an attic will generally be too warm and dry for root cellaring.

Small Scale Indoor Storage: An inexpensive approach to root cellaring is small scale indoor storage. Even small houses generally have areas such as a cool closet or corner that can be utilized for produce storage.

Styrofoam or metal coolers can be used for storage of root crops. By packing damp produce in plastic bags, four to five pounds each, the humidity can be kept fairly constant.

Trash cans or metal barrels can also be used to store root crops. Use an insulating material such as sawdust, layers of newspapers, or leaves, to keep the produce from touching the metal sides. The lid should fit tightly.

Ventilation may be necessary in some situations, especially if storing produce with strong odors such as cabbage. With a little innovation and modification, several areas in a house or cabin can be utilized for root cellaring. The basic principles are easily applied to small scale storage situations.

Large Scale Outdoor Storage

Hillside and Underground Storage: If serious root cellaring is to be undertaken, and there is no suitable cellar or basement, consider building a root cellar as a subterranean exterior building. This requires stable soil, however, and would usually

not be feasible in the unstable conditions often found in Alaska, such as permafrost or thermokarst areas. Traditional designs include building into a hillside, and digging a hole which is entirely underground.

Whether or not permafrost ground can be utilized in this manner is controversial. In some situations, once a space has been blasted, chipped or melted into the permafrost, with proper and adequate drainage provided, a "permafrost cold hole" can be reasonably stable. However, it is almost impossible to regulate it suitably for root cellaring, since any warming above freezing will cause melting and subsequent shifting. Such a permafrost hole would likely be too cold to preserve fresh garden produce in the winter.

Permafrost can be useful in keeping produce cold in the summer or the transitional seasons of autumn and spring. A traditional rural method of keeping fish and berries cold in the fall is to dig a pit to permafrost level (two to four feet deep) and cover it with insulating material.

Underground root cellars and root cellars dug into hillsides perform well in Alaska if built on stable soil with fair to good drainage. The standard design for this kind of root cellar is based on an optimum size of 10 by 10 feet to allow for a maximum storage area, which can be regulated for temperature and humidity. This design requires a seven foot ceiling, an insulated roof and at least two feet of soil above the roof of the cellar.

The major problem with building a root cellar in the earth is regulating the damp conditions. The high humidity that is so good for food storage promotes rotting in any kind of wooden structure. Reinforced concrete walls are the best permanent solution, but few people will be able to invest that much money into a root cellar. Wood treated with creosote (Penta-

chlorophenol) is not recommended as it may leak toxic fumes to the stored food. (Note: This is an EPA controlled substance.) However, pine or fir trated with copper salt preservatives can be used.

If the soil is very stable, it is possible to simply dig a hole and leave the walls unsupported. If it is possible to get a good vapor seal on the ceiling timbers, the result will be a low cost root cellar which will last indefinitely. There is no way to completely eliminate the rotting problem except by using concrete. A root cellar can be built with wood timbers supporting the walls and ceiling, but it will have a limited life span.

Well insulated doors, one at the top and one at the bottom of the stairs, are required to protect the environment of the root cellar. The outdoor cellar will also require venting. Two vent pipes, an inlet and an outlet, with dampers, will serve to circulate air.

The outdoor cellar will need to be heated in extreme cold. Though some publications recommend light bulbs as a source of heat, they are not reliable, and may need to be supplemented during long spells of severe cold. If no electricity is available, kerosene heaters, lights, or candles can be used. However, care must be taken to vent the fumes to avoid giving the produce an off-flavor, Furthermore, the root cellar must be monitored carefully to be sure the temperature is not becoming too warm.

A fully automated system is by far the most convenient. A small electric heater connected to a thermostat set for 32 degrees F. will keep the root cellar from getting too cold. (A household thermostat, normally set for indoor conditions, can be opened and reset to 32 degrees F.) This is most likely to be successful when the ambient temperatures are approximating freezing, so that testing and adjustments can be made. A thermostat can also be set up to work like a smoke alarm, using a buzzer or a light to

indicate that the temperature in the root cellar is critically low.

The root cellar temperature will be too warm for good storage conditions during the summer. This is a good time to thoroughly clean and air all the storage containers. As soon as the nights begin to get cold, start leaving the door open to let in the cold air. Close it again during the day.

Constructing a root cellar anywhere is a highly innovative production. In Alaska, the extremes of temperature can make certain factors, such as insulation and emergency heating, critical. However, if these requirements are satisfied adequately, the cold soil and low temperatures can provide for a long storage time not always available in warmer or more diverse climates.

There are several specific designs for root cellars included in the books and publications listed in the bibliography. Building a root cellar takes time, and requires more time for monitoring and modifications, before it is ready to be used. A careful assessment of the physical situation, and the investment of time and money versus the end product of stored produce, should be the starting point. Do not forget that the garden is the major reason for the root cellar to exist. Do not build a large storage facility until there is sufficient produce to put in it.

Small Scale Outdoor Storage

If commitment and situation are uncertain, consider one of the following small scale methods for root cellaring.

There are methods for storing produce on a small scale basis outdoors. Two common methods include conical mounds above ground and underground pits. Be advised that these methods have been developed for mild climates. Keep in mind that with these methods, it is necessary to protect the produce from freezing.

Cold Climate Pits: A pit can be made to withstand cold temperatures. However, during long spells of extreme cold there is always the danger of freezing the produce. A good method of constructing a cold climate pit has been developed by Walter Needham (Putting Food By). The following procedure has been successful in cold New England winters, and may be a viable technique for many areas of Alaska.

Choose a well drained rise of land to dig the pit. Size will depend on the amount of material to be stored (see below). As ground or runoff water must be kept to a minimum, rim the pit with soil and add a drainage ditch around the edge for extra protection. The pit should be dug to about two feet deep and four feet wide at the bottom. Do not use rocks or leave rocks where they can contact the produce, as they will conduct frost.

With outdoor storage, dry sand should be used to pack the bottom of the pit, since soil, if it has any moisture at all, will freeze. Pack the bottom of the pit with sand or sawdust three inches deep. Cover the sand with two to three inches of insulating material. Layer the produce on top of the insulating material, not more than a foot deep. Pour sand down into all the crevices. Use insulating material to fill the remaining hole, and mound over the produce. An additional five to six inches of soil can be added for extra protection against the cold. Pit storage works best for cabbage and root crops. Separate the produce with hay or leaves to keep down transference of odors.

Be sure the insulating material (leaves, newspaper, sawdust) is dry, and as thick as possible, to retain a mound shape. Once very cold weather has set in, do not disturb the storage pit until all the contents are needed. Each pit should hold only as many vegetables as can be used before spoilage occurs.

Anytime produce is stored outside rodents may become a problem. The best method for dealing with this situation is to line the pit with quarter-inch mesh screen hardware cloth.

Cold-Climate Buried Containers: Walter Needham's method of utilizing buried containers for root cellaring has been successful at minus 20 degrees F. temperatures. Metal trash cans, wooden barrels, or steel drums that have not contained chemicals can be used to store produce outside. Well drained land is essential, and a bank or a hill is preferable.

Into the side of a hill or bank, dig a space slightly larger than the number of containers that will be buried. Line the hole with insulating material. Punch several holes in the bottom of the container and place rocks or bricks at the bottom of the hole to facilitate drainage. Dig a shallow V-shaped drainage ditch to carry surface water away from the barrels.

The vegetables to be stored should be placed in alternating layers with insulating material. Make sure the cover of the container fits snugly and is well insulated. Mound the insulating material over the top of the barrel, making it at least two feet deep. A plastic cover laid over the top will insure that the material does not lose its insulating qualities from rain. Once snow begins to fall, it can be used as additional insulation. Avoid opening the pit more than once a week. Pile the snow back to add insulation.

The success of small scale outdoor storage depends upon the greatly variable factors of location, climate, and soil. Easy access to the area is very important also.

In-Garden Storage: In-garden storage is usually not successful in the continental and arctic climates of Alaska, because the ground freezes too rapidly and deeply. In the south central areas of the state, root crops protected by a thick layer of mulch may be left in the ground during the frosts of late fall and harvested before the deep freezing of winter. This method requires that the soil be fairly dry to keep the produce from rotting.

ROOT CELLARING LESSONS AND ACTIVITIES

Lesson 1: INTRODUCING ROOT CELLARS

OBJECTIVE:

Students will be able to discuss the concept of root cellaring and its place as a means of food preservation in both a historical and practical perspective.

BACKGROUND:

Refer to the introduction and overview for full background information. This is a good time to require the students to keep a notebook. If they begin now, with the interviews, and describe all the information they obtain from reading and the results of their experiments, they will have an excellent personal record of the experience of root cellaring. It is a good exercise for teaching the value of keeping both a garden and a food storage notebook. To keep students personally motivated, develop an individualized, simple method of record keeping. A sample record sheet is included in the appendix.

SUGGESTED ACTIVITIES:

1) Discuss the concept of root cellaring. Include historical use, why it is no longer used extensively, and why it is regaining favor (see overview).

2) Explore the history of root cellaring. If available, use the archives or other library resources to research historical use of root cellars in Alaska. In isolated communities, contact the nearest library or personally contact the Alaska Library Network, Regional Services, Fairbanks Northstar Borough Library, 1215 Cowles St., Fairbanks, Alaska, 99701. Once a member of this network (no fee), a card user may request information on any subject. Books and articles can be lent and returned by mail.

3) Interview elders or other people in the village about how fresh food was traditionally stored, other than by freezing, or drying. Consider using tape recorders (with permission of the speaker) so the class can take notes after rather than during the interview. Prepare questions for the interview in advance.

Lesson 2: COMPARING METHODS OF FOOD PRESERVATION

OBJECTIVE:

Students will be able to compare the differences in cost, quality, and safety of root cellaring versus other methods of food storage.

BACKGROUND:

Refer to the introduction and overview for full background information. The best approach to teaching this unit would be to actually involve the students in canning (or freezing or drying) some produce while they are researching costs. For example, place the canned produce in the cold storage as soon as it is built, to illustrate how the high humidity can cause lids to rust. Students will learn the skill of canning produce; at the same time they will be able to compare the differences in cost and labor between the two methods of food storage. Students will learn to distinguish between produce that is best canned and produce that is best kept in cold storage.

A supplementary skill in food preservation that can be developed in this lesson is understanding how to use Cooperative Extension bulletins and canning recipes. Use the food preservation books (see bibliography), and the publications available from the Cooperative Extension offices (listed in the appendix).

SUGGESTED ACTIVITIES:

1) Can some produce. Use several different varieties if possible. Go through the whole procedure from beginning to end. Mail order or locally purchase the cans and lids, find the recipe or instructions, read about the canning procedure, can the produce, taste test, and store.

2) Research and detail (in the students' notebooks) the procedures and costs involved with freezing and canning produce.

3) Research and discuss botulism as a major risk to be dealt with in canning.

4) Ask the students to list possible problems of canning and freezing (cans may freeze, electricity could go out) and drying.

5) Plant a paper garden. This can be as literal as using paper cut-outs for demonstration or to simply use a garden plan. Have the class decide what kinds of produce they like best and figure out what would be consumed in a year. Then decide how much needs to be planted and stored. (Figure on at least a 10% spoilage rate.)

Lesson 3: APPLYING THE PRINCIPLES OF ROOT CELLARING

OBJECTIVE:

Upon completion of this lesson, students will be able to recognize and apply the basic principles of root cellaring by finding or making areas in the school suitable for cold storage. (This lesson requires a long observation and experimental period of at least one full growing season, preferably two.)

BACKGROUND:

Refer to the introduction and overview for full background information. There may have an area in the school that is naturally suited to root cellaring. If not, begin this lesson by building a small scale storage unit.

Choose one of the types of small scale facilities described in the overview, such as an insulated box, cooler, plastic bags or barrel. Use the references in the root cellaring bibliography for construction detail. Start small, so that students can get the hang of manipulating the variables of temperature, humidity, and ventilation, before going to a bigger project. It will take time to learn how to get a good mix of warm and cold air to bring the temperature into the proper range.

In the early fall, a cold hole, dug into the ground with an insulated cover, can be used as a temporary storage facility.

SUGGESTED ACTIVITIES:

1) Stock the storage area, after enough trials have been performed to consistently get the right temperature with a variety of produce. Look up keeping times; write in notebooks, or post. Keep some produce of the same kind in a warm area for comparison. Check daily. As produce goes bad, demonstrate how the bad parts can be cut away, leaving usable product. Have students record the keeping time; compare with the actual conditions, cold and warm.

2) Experiment with raising and lowering the humidity of the storage area. To raise humidity, use one or more of the following techniques:
   a) Sprinkle the floor of the storage area with water as often as necessary so the humidity is in the proper range (approximately 85 percent), as registered by the measuring equipment.
   b) Place large pans of water under the vent areas.
   c) Place wet material, such as straw or sawdust, on the floor of the storage area to keep it moist.
   d) Store produce in plastic bags, with punched quarter inch holes for ventilation.
   e) Pack produce in moist sand. Be sure the sand is damp, not wet. It should fall apart when squeezed, leaving a few particles stuck to your hand.

   To lower the humidity, use the following technique:
   a) Place candles or a candle burning lantern in the storage area. Note that doing this raises the temperature of the area to an undesirable level very quickly.

3) Keep some produce under the <u>wrong</u> conditions. For example, keep squash or onions cold and moist; and apples, root crops or cole crops warm and dry. Compare to the produce kept under correct conditions.

4) Compare the condition of potatoes under different lighting regimes. Place some potatoes in the dark, some under fluorescent lights, and some under natural sunlight. Those in the light will turn green as the poison solanine accumulates. Be sure students understand that this green color indicates a potato which should not be eaten.

5) Experiment with manipulating conditions in a stocked root cellar, if available. Once the temperature and humidity are relatively stable at the right levels, begin to add produce. First put produce in storage a little at a time, and measure the increase in temperature, and fluctuations in humidity as it gets filled up. When the temperature becomes too high, it must be vented. Depending on the situation, this can be as simple as opening a window or door slightly to building a venting flue for the storage areas. Vent the area until the temperature returns to the appropriate range for root cellaring. Try different varieties and amounts of produce in the storage area until adjusting the temperature, humidity, and ventilation are easy and fast procedures.

6) Use a thermometer to evaluate if the temperature is higher very near the produce than away from it. This would be expected especially from produce that respires heavily (such as apples or cabbages).

Lesson 4: UTILIZING ETHYLENE GAS TO ENHANCE TOMATO RIPENING

OBJECTIVE:

Students will be able to manipulate amounts of ethylene gas to provide both ripening and maximum food storage time.

BACKGROUND:

Alaska's short summers assure plenty of green tomatoes. By understanding how to store and how to ripen tomatoes students will learn how to most optimally handle the green tomato crop. (Note: In addition to teaching procedures on ripening and storing tomatoes, be sure to indicate that there are some excellent uses for green tomatoes (i.e., pickled, fried, etc.). Consult the Cooperative Extension Service.)

The following comparisons and experiments deal with ethylene gas, a hormone which is respired heavily by tomatoes, as well as by apples and pears. Ethylene gas facilitates ripening. Therefore, it is essential that this quality is clearly understood so it will be an asset, not a detriment, to cold storage.

The principle of working with ethylene gas is simple. Assume that two events are likely to occur during an Alaskan gardener's tomato growing experience. First, there will be green tomatoes on the plant early in the season which may take quite a long time to fully ripen, especially with cool days and/or nights. Second, that a summer or fall frost will be forecast just when the plant is heavy with mature, but still green, tomatoes. In the first case, it is desirable to enclose and accumulate the respired ethylene gas to more rapidly ripen the mature-green tomatoes. In the second, the object is to store the crop for as long as possible; thus minimizing the ripening effect of ethylene gas, by venting it away from the tomatoes, is important.

SUGGESTED ACTIVITIES:

1) Simulate the situation an Alaskan gardener would often experience when the first fall (or late summer) frost occurs. If conditions allow, grow a dwarf tomato plant in the classroom under flourescent lights. Pick an early ripening variety. When the plant begins to bear green tomatoes, pick most which are at the "mature-green" stage (nearly full grown or full grown with cream colored streaks visible at the blossom end, with fairly tough skin which releases from the stem easily). Also pick some tomatoes which are soft and not yet full grown. Mature-green tomatoes will ripen under the right conditions. Immature tomatoes may not reach maturity before they shrivel up.

2) Set up several observation trials to demonstrate the effect of ethylene gas. For all of these experiments, use mostly mature-green tomatoes; compare with immature fruits to demonstrate how they differ in ripening ablility. Keep records of ripening times.
   a) Place tomatoes on a tray in an enclosed plastic bag at room temperature. This will trap the ethylene gas, thus causing them to ripen more quickly. Compare with:
   b) Tomatoes and apples together (a few apples are sufficient) under identical conditions to those descibed above.
   c) Tomatoes in a ventilated area.

   The tomatoes mixed with apples will have the greatest acumulation of ethylene gas, and will therefore ripen very quickly. The ventilated tomatoes will ripen the slowest. These trials will demonstrate how to use ethylene gas as a ripening agent. Rather than leaving green tomatoes on the plant which will take a long time to ripen, it is possible to greatly speed the process and begin enjoying ripe tomatoes earlier in the season.

3) Demonstrate the other effects of ethylene gas and why ventilation and segregation of produce is important. Set up the following observation trials, using apples as the source of ethylene gas and a plastic bag to enclose it. Ethylene gas will have the following effects:

a) Carrots will taste bitter.

b) Potatoes will sprout. Explain that potato sprouts are poisonous.

c) Cabbage will lose its color.

4) Use a combination method to store and ripen tomatoes. Mature-green tomatoes will store up to two months if ethylene gas can be kept at a minimum.

a) To store as long as possible, keep them at 50 to 65 degrees F., with a high humidity (about 90 percent). Try storing green tomatoes wrapped in paper, or unwrapped with newspapers under them. Another method is to bring in the whole vine and let it hang (50 degrees F. or higher in a well ventilated area). Keep track of ripening times.

b) To ripen tomatoes, take several at a time and remove them to a warm environment (60 to 70 degrees F.).

5) Store apples under several different conditions and compare keeping times. Since apples may be bought in quantity and stored in a root cellar, it is important to recognize that the ethylene gas they respire can cause problems for other produce. To avoid serious problems, segregate the apples as much as possible from other produce, especially potatoes. Put apples in the storage area, but find the best place for them where they cause the least problems to other produce. If apples are wrapped individually in paper, they will respire less and last longer. They can also be stored in boxes or in large plastic bags with about 12 quarter-inch "breathing holes" cut into them.

Lesson 5: BUILDING SMALL SCALE STORAGE FACILITIES

OBJECTIVE:

Students will design and build a small scale storage facility. Upon completion of this lesson, students will be able to demonstrate how to build a facility appropriate for the location and use.

BACKGROUND:

Refer to the overview for full background information. Choose one or more designs from the publications listed in the root cellaring bibliography. Choose a different design than the one used previously, in the principles of root cellaring unit. Have the students work through the activities with each design.

SUGGESTED ACTIVITIES:

1) Choose one or more outdoor small scale projects. Build it, stock it and monitor what happens. Keep a notebook. Was it conveniently located? Did it freeze? Did rodents get in? This activity should be run for several months during the winter. At the end of an allotted period of time, have the students describe and evaluate what went wrong and how they would provide remedies to particular problems.

2) Do the same for indoor methods. Try several if possible.

3) In the fall, build a cold hole, stock with produce or berries and fish, fit it with an insulated cover, and monitor into the winter. Note when it became unusable, due to low temperatures.

4) In the fall, providing the garden is planted, leave some root crops in the ground. Mulch heavily with insulating material and monitor how long it is possible to continue to take crops out of the ground before it freezes too hard.

5) Have students find a suitable storage area in the school for produce that requires warmer storage conditions, such as squash, onions, and garlic.

Lesson 6: DESIGNING LARGE SCALE STORAGE FACILITIES

OBJECTIVE:

After completing this lesson, students will have a theoretical understanding of how to build an exterior or basement root cellar, from beginning to end. They will use this lesson to blueprint a root cellar design.

BACKGROUND:

Refer to the overview for full background information. Choose one of the following designs for blueprinting: 1) the cellar/basement root cellar, or 2) the outdoor root cellar.

If the decision is made to build a full scale root cellar, there are several designs which can be followed (see bibliography). All designs will need to be modified for the individual situation; therefore this blueprinting exercise should be considered a prerequisite for construction. It will give students a chance to go through the process on paper before the expense and labor of building begin. Depending upon the level of interest, and the situation, it may be possible to blueprint both designs before choosing one to build. Concentrate on the one that is most suited to the classes' needs.

SUGGESTED ACTIVITIES:

1) Choose a design and "build" a root cellar on paper. Research and discuss which type of root cellar would be best suited for the local situation. Evaluate the soils of the area if it is to be an outdoor cellar (see overview). Be sure to compare total costs, in the short and long run, noting money saved by storing garden produce.

2) Ask students to decide where they would put their own root cellar, and what kind they would build, if they were going to construct one on their own property. If possible, they should research the specifics (soils, size, and location) and be able to discuss why they made their choice.

3) Have students make a list of items which could be used for storage containers.

4) Experiment with a low temperature warning device. Reset a thermostat and attach to a buzzer. If possible, use with an electric heater, as described in the background section.

Lesson 7: HANDLING THE PRODUCE

OBJECTIVE:

Students will observe and demonstrate how injured produce decays more quickly; and how field heat affects the root cellar's temperature.

BACKGROUND:

Handling produce for cold storage is the same no matter what method of root cellaring is chosen. Pick mature produce which is in good condition. Nearly mature produce will usually ripen satisfactorily in the root cellar. Any produce with signs of decay, disease, insect damage, or injury should be utilized some other way, such as canning.

Plant and harvest for fall storage. Plant early varieties for fresh eating, and late (often called storage) varieties for keeping in the root cellar.

Handle produce as little as possible to avoid damaging. Gently brush off dirt; however, do not scrub harshly or use water.

Harvest produce on a cool day or in the morning. Vegetables will retain warmth, called field heat, from the afternoon sun, for a long time. If they are picked when warm, and placed in a root cellar, they can significantly raise the temperature in the storage area.

Check produce regularly and remove anything that shows signs of spoilage. Don't be discouraged! Expect spoilage, it is part of the root cellaring process. This method of storage is a race with decay. Spoiled produce can be used as food for pigs or for compost. Count on spoilage (approximately 10 percent is normal), despite best efforts, and store more than necessary.

Do not keep canned goods in a root cellar. The humidity required by vegetables is too high and will cause cans to rust, which can be dangerous if it causes leaks, indicating potential danger from botulism.

All produce should be placed on a layer of insulating straw, hay, clean dry leaves, spagnum, peat moss, or dry sand. When layering produce, always put an insulating layer of the above materials between them. Bins should be moveable. In late spring when the cellar is empty, clean it out, take the bins out to scrub and air outside.

Again, encourage the students to keep a notebook. This is part of the gardening process. Do not rely on memory to record when the potatoes and turnips ran out. Keep a record of what goes into the cellar and how quickly it was consumed. The next summer it will be possible to be far more accurate about what should be planted.

SUGGESTED ACTIVITIES:

1) Compare keeping times of produce stored in good condition versus poor condition (bruised or pricked with a knife or fingernail).

2) Demonstrate the effects of field heat. Place some produce in the hot sun (by a south window is fine, or anywhere where the temperature is very warm) for a day. At the end of the afternoon, place in cold storage. Observe and record what happens to the temperature inside the root cellar.

Lesson 8: STORING THE PRODUCE

OBJECTIVE:

Students will be able to list types of produce which grow and storewell in Alaska. Students will be able to demonstrate how storing potatoes in cold storage changes the flavor. Students will be able to demonstrate how to cure potatoes and squash.

BACKGROUND:

Fortunately, many of the vegetables that store well are also ones that grow well in Alaska. Possible exceptions are squash and pumpkins, which are excellent producers, but can be marginal crops if grown outside a greenhouse because they are susceptible to frost. Each vegetable, of course, has its own optimum storage conditions. When keeping many different kinds of vegetables in the same storage area, group them by general requirements and aim for an average temperature and humidity.

An easy way to group vegetables is by their growing requirements. Vegetables that like cool moist conditions store best in a cool moist environment. Thus, the root cellar is the logical place to store the root crops and the cole crops, such as cabbage, cauliflower and brussel sprouts.

Apples also require cool, moist conditions and are the best keepers of the fruits. It may be worthwhile to purchase apples in quantity when they are cheap and relatively fresh, then store them throughout the winter.

Vegetables that need warm, dry growing conditions need to be stored in a similar environment, such as an attic. Thus, squash and pumpkins should not be stored in the root cellar. The vegetables that need cool, dry growing conditions (onions and garlic) need the same storing conditions.

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SUGGESTED ACTIVITIES:

1) Become familiar with crops which are best for root cellaring. List all the produce that grows well in Alaska. List the cold storage time for each (see appendix).

2) Learn how to group produce into three storing categories: cold and damp (root cellar crops), warm and dry (squash), and cool and dry (onions, garlic). Note that these categories are similar to the growing conditions required by each group of produce: cool weather crops require cold storage; warm weather crops need warmer conditions;and onions and garlic do well in cool conditions.

3) Compare the quality of potatoes stored under different conditions. Put some in cold storage for several weeks. Take half out, leave at room temperature for a few days. Take the other half out and do a taste test. Explain how sugars convert to starches and how temperature affects that process. Potatoes store best at 38 degrees F. If kept at 35 degrees F. they will turn starch to sugar and become unpleasantly sweet. Therefore,store them in the warmer, higher locations of the root cellar. If they must be stored at cooler temperatures, expose them to room temperature for a week or so to reverse the sweetening process.

4) If possible, in the fall or late summer, experiment with freshly harvested squash and potatoes. Put some into cold storage without curing. Compare keeping times with cured produce. Cure potatoes (in darkness) and squash by leaving them at room temperature for about ten days. Note how the skins got tougher during this process. They can't be easily rubbed off (potatoes) or pricked with a fingernail (squash).

5) Store several kinds of wild berries in cold storage. Keep notes on which kinds store well.

Lesson 9: APPLYING OTHER USES FOR THE ROOT CELLAR

OBJECTIVE:

Students will be able to list perishables, other than locally grown produce, which can be stored in a root cellar.

BACKGROUND:

The root cellar can be used to store cheese in large quantities, as well as grains, cured meats, sauerkraut, pickles, seeds, nuts and eggs. It is also an excellent place to overwinter earth worms (which produce a rich compost) in a container or to keep potting soil. If there is room, it is possible to keep flower bulbs or even dwarf fruit trees in the cellar during their normal dormancy period. The containerized dwarf fruit trees can be taken outside when spring temperatures warm sufficiently.

SUGGESTED ACTIVITIES:

1) Have students make a list of what they could keep in a root cellar. Collect the lists, and make a master list of the best ideas. Have students write the master list in their notebooks. Discuss why some ideas may not be usable (such as keeping canned goods due to the danger of rusting lids).

2) Ask students to list all of the places in their houses that could be used to store produce. Be specific about what kinds of produce and where they would be best stored in the root cellar.

ANNOTATED BILBLIOGRAPHY FOR ROOT CELLARING

ANNOTATED BIBLIOGRAPHY: ROOT CELLARING

Bubel, Mike and Nancy Bubel. Root Cellaring. Rodale Press, Emmaus, Pennsylvania, 1977.

This is the bible of root cellaring. Written by a couple of veterans in a conversational style, it includes types of vegetables to grow for storage, harvesting and preparation methods for storage, plans for different types of root cellars, and examples of other people's root cellars and recipes. If you decide to get serious about root cellaring or just want an overview of the possibilities, this is the book.

Emery, Carla. Old Fashioned Recipe Book. Bantam Books, New York, 1977.

Emery's book is a good reference if you do not mind wading through her philosophy and anecdotes for the information. Her book is very much oriented to people with children who go "back to the land" and live a homesteading life with a garden and some livestock. As such, it can be a bit preachy about the "good life". However, it does offer good basic information on everything from preserving food to raising livestock. The short section on root cellars is best read for her experiences in dealing with the practical realities of keeping fresh foods in cold storage.

Garden Way. Building and Using Your Root Cellar. Garden Way Bulletin A-22, Garden Way Publishing, Charlotte, Vermont, 1980.

The design presented in this publication is for a root cellar or storage room in the corner of a basement, so it has limited use for the Alaskan user. It does present the basics adequately and is a good value for the price; however, someone who is serious about root cellaring would want more detailed information. There is a good chapter on how to handle crops to be put into cold storage, with details on the temperature and humidity requirements.

Hertzberg, Ruth, Beatrice Vaughn, Janet Greene. Putting Food By. Stephen Greene Press, Brattleboro, Vermont, 1975.

Though there is just a short section on root cellaring, this book is one of the best references for cold-climate food storage. It has specific suggestions for designing small-scale outdoor food storage systems. This is an all purpose book, as its name implies. It contains solid information on canning, freezing, preserving, drying, and curing, as well as root cellaring. An excellent reference.

Kulla, Patricia. Making Your Summer Garden Last All Year. Lycem Books, Wilton, Connecticut, 1975.

A good, well rounded reference for food preservation. Some information, as in Stocking Up and Putting Food By, though not as well presented. Short, but good, section on root cellars.

Organic Gardening ed. Build It Better Yourself. Rodale Press, Emmaus, Pennsylvania, 1977.

This is an excellent book and highly recommended to anyone who wants to build something, be it a bird feeder, root cellar, cold frame or garden cart. The directions are easy to read, the diagrams are well done and the final product, in my experience, is always worthwhile. Good section on small-scale and regular root cellars.

Stoner, Carol ed. Stocking Up. Rodale Press, Emmaus, Pennslyvania, 1977.

This is a good all purpose book for methods of food preservation. It has a basic chapter on root cellaring, with some innovative ideas and good diagrams. A good reference book, equivalent to Putting Food By.

EVALUATION OF THE ROOT CELLARING UNIT

Please take the time to fill out the following evaluation form. Your feedback as a teacher will be used to help revise this unit. Attach additional pages if necessary.

1) Name, address, and phone number:

2) Dates and length of time this unit was used:

3) Previous root cellaring experience of you and your students:

4) Ages and numbers of students involved in the root cellaring project.

5) Portion of the unit that was used:

6) How did this unit aid your root cellaring project?

7) What can be done to improve this unit?

8) Please discuss your personal experiences in using this unit and list your recommendations and comments for revision.

9) Did you develop new activities or materials while you were using this unit which you think may be appropriately added when this unit is revised? If so, please describe.

APPENDIX

PERSONAL OBSERVATIONS

PERSONAL OBSERVATION OF DEMONSTRATION GARDEN FLOWERS

1983 AGRICULTRAL AND FORESTRY EXPERIMENT

STATION, UNIVERSITY OF ALASKA, FAIRBANKS

ANNUAL FLOWERS THAT DO NOT NEED TO BE STAKED AND ARE OPEN AND ATTRACTIVE IN RAINY WEATHER:

Aster
Lupine
Rudbeckia
Cosmos (Psyche)
Calendula
Celosia
Thistle (but very late Bloom)
Matricaria
Dusty Miller
Echium
Begonia
Ageratum
Impatiens
Viola
Marigold
Foxglove
Shasta Daisy
Zinnia
Tidy Tips
Statice
Dianthus
Verbena
Geranium
Bellis
Nemophilia
Alyssum
Primrose

PROBLEMS WITH ANNUAL FLOWERS AFTER CONSISTENT RAIN

Kochia	needs to be staked
Dianthus (large)	falls over
Chrysanthemum (tall)	falls over
Lavatera (Silver Cup the best)	falls over
Lobelia	falls over
Linum	falls over but open
Morning Glory	closed
Bartonia	closed
Rodanthe	closed
Acrolinum	closed
Golden Poppy	closed
Petunia	closed
Gazania	closed
Dimorphotheca	closed
Calandrina	closed
Veniduim	closed
Nierembergia	closed
Portulaca	closed
Mesembryanthemum	closed
Chysanthemum multicale	closed
Strawflower	closed
Poppy	loose petals
Godetia (early)	pretty but soggy
Nemesia (early	soggy
Pansy	soggy
Asperula (early)	dies off
Chrysanthemum (Paludesum)	part way open

ANNUAL FLOWERS RESISTANT TO 30 DEGREES F. FROST

Chrysanthemum
Verbena
Godetia
Petunia
Stock
Layia
Shasta Daisy
Foxglove
Statice
Acrolinum
Aster
Dianthus
Pansy
Bellis perennis
Linum
Alyssum
Poppy
Dusty Miller
Echium
Scabious
Calendula
Lupine
Bartonia
Rodanthe
Thistle
Carnation
Matricaria
Viola
Calandrina
Pholx
Mesembryanthemum

MARGINAL RESISTANCE TO FROST

Nemophila
Dimorphotheca
Geranium
Salvia
Hollyhock

FLOWERS FOR SHADY (LESS THAN 6 HOURS SUN/DAY)

Begonia
Fuchsia
Impatiens
Lobelia
Mimulus
Coleus

FLOWERS FOR PARTIAL SUN (MORE THAN 6 HOURS SUN/DAY)

Nemesia
Pansy
Viola
Petunia
Geranium
Lavatera
Marigold

FROST INTOLERANT CROPS

Frost intolerant vegetables/herbs which generally grow well in Alaska

Basil
Cucmbers
Potatoes
Tomatoes (early maturing or basket varieties)

Marginal crops (frost intolerant and need warm growing season)

Beans
Eggplants
Peppers
Most Tomatoes

Flowers that grow exceptionally will in Alaska but are frost intolerant

Marigolds
Nastursiums
Zinnias

An Alaskan Garden

Pick early (before frost)

- garlic
- pumpkins
- squash
- tomatoes

Light frost 28-31°F

- beets
- broccoli
- celery
- kohlrabi
- onions
- radishes
- rutabagas

Medium frost 24°-28°F

- brussel sprouts
- cabbage
- chinese cabbage
- cauliflower
- turnips

Heavy frost under 24°F

- collards
- kale
- leeks
- parsnips
- chard
- carrots

Saving Seeds

Three Factors to Consider:

1. Temperature: Seeds maintain longer at lower temperatures. Cold will not affect them, if they are dry. The optimum temperature for long viability is -4°F.

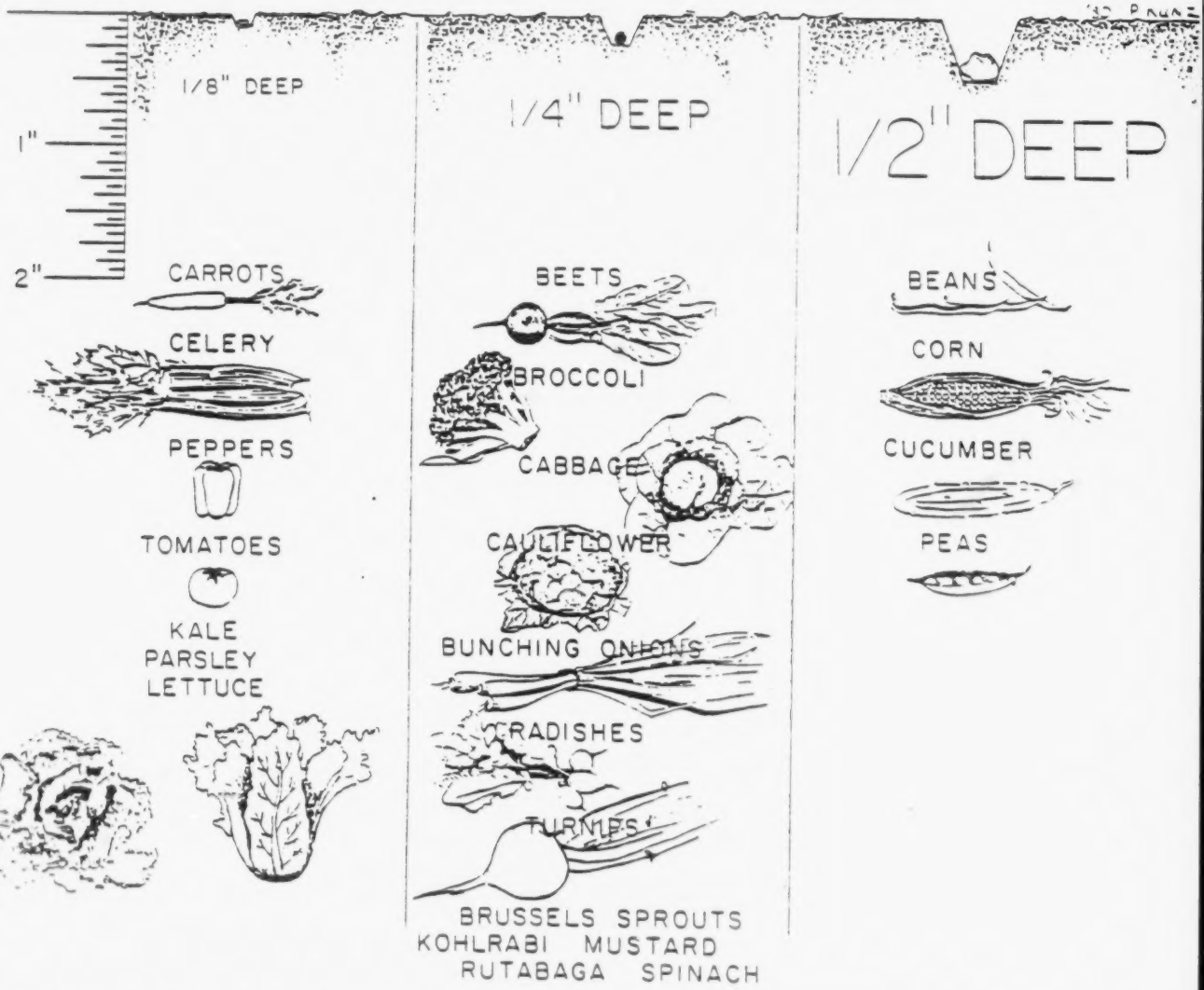
2. Oxygen: Low O_2 levels for long viability. Keep them sealed in plastic or in jars. Squeeze out any excess air.

3. Moisture: Low moisture is essential. Use dry milk wrapped in tissue paper or a commercial dessicent. Do not let touch seeds.

LESSON REFERENCES

SEED PLANTING DEPTHS FOR ALASKA

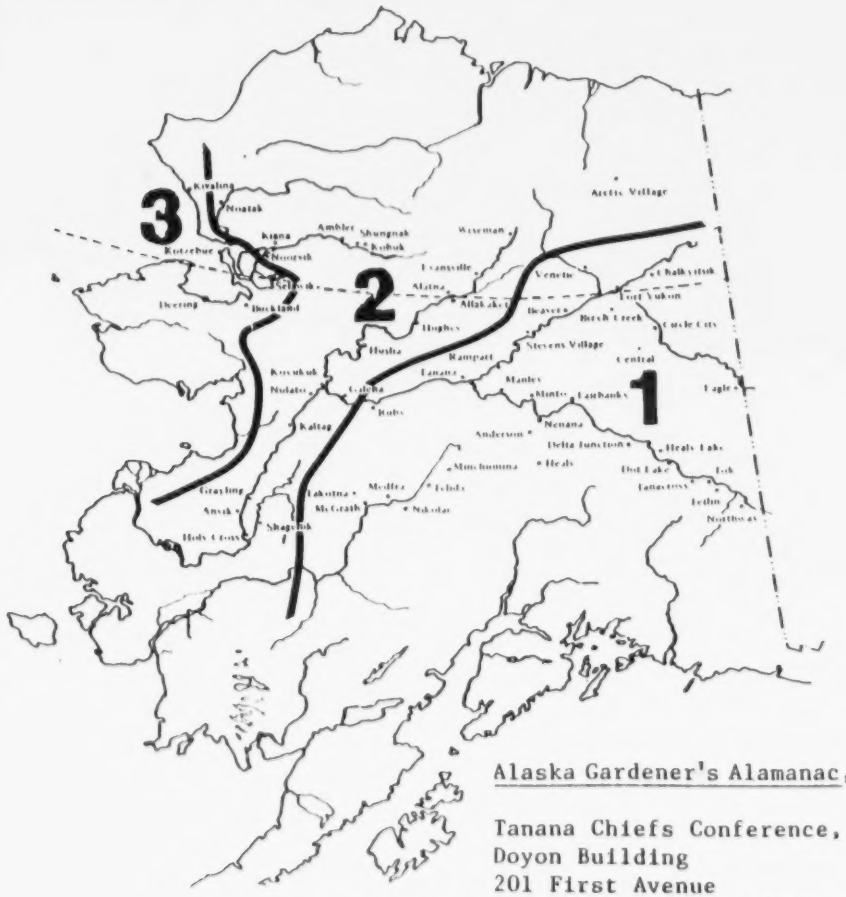
By P.Kunz
Tanana Chiefs Conference, Inc.
Agriculture Department



BECAUSE OF ALASKA'S SHALLOW PLANTING DEPTHS, CARE MUST BE TAKEN TO KEEP SOIL MOIST AT ALL TIMES!

GARDENING CLIMATE ZONES

This map shows the three climate zones for gardening in the Doyon and NANA Regions. Look below, find your community on the map and decide which zone you are in. It's a good idea to take a highlighter or red pen and mark the planting tips in the calendar that mention your zone. The suggested starting dates for different vegetable transplants for each climate zone are listed on the monthly pages.



Alaska Gardener's Alamanac, 1985

Tanana Chiefs Conference, Inc.
Doyon Building
201 First Avenue
Fairbanks, Alaska 99701

Traditional Planting Dates and Ranges of Planting Times for:

Zone 1: June 1 (May 25 June 7)
Zone 2: June 7 (June 1 June 10)
Zone 3: June 14 (June 7 June 20)

The lines drawn on this map are meant to serve as general guides for the climate to expect in your area. It may be that your experiences with planting dates and weather are different than outlined here. **Microclimate** is an important influence on gardening climate. For example, the soil in gardens located on south-facing slopes may warm quicker and be ready for planting sooner than is average for an area. On the other hand, gardens in low spots or "frost pockets" may not be ready to plant until after the usual planting date.

Zone 1: This zone includes towns and villages along the Upper Yukon, Upper Kuskokwim, and Tanana Rivers. The area is generally the first to warm up in the spring and summer temperatures are usually warm. Rainfall is low, especially early in the growing season. Warm season crops such as squash, corn, beans, and tomatoes are successful out-of-doors most years when grown in containers or through clear plastic laid over the soil.

Zone 2: This area includes communities along the Lower Yukon, Koyukuk, and Kobuk Rivers. This zone warms up more slowly, either because it's closer to the coast or further north than Zone 1. As a result, gardens in Zone 2 are usually planted a week or so later than in Zone 1. Summers tend to be warm, but frosts come early in the northern part. Summers are longer, but cooler, along the Lower Yukon. Warm season crops are successfully grown outside only when planted in containers, through clear plastic and/or under cloches.

Zone 3: This zone includes the coastal villages in the NANA Region, and probably includes Arctic Village as well. Ice remains in this area until late May-early June which causes the soil to warm very slowly. Summer temperatures are cool: it rains more often and tends to be windy in Zone 3. Warm season crops must be grown in a greenhouse. It helps to grow cool season vegetables (cabbage family, lettuce, turnips, peas) through clear plastic laid over the soil.

SOIL WARMING

In Alaska, soil temperature is more limiting to good plant growth than air temperature during the growing season. In fact, plants grow best with "cool heads and warm feet." Gardeners in all three zones should use soil warming techniques, even in areas that are free of permafrost.

One of the easiest and most effective methods of warming the soil in your garden is to mound the soil up into **raised beds.** This exposes more of the soil surface to the warming rays of the sun. The soil in **containers** (boxes, pots, old tires) is warmer because it is raised up and there is less volume to be heated. Laying **clear plastic mulch** over soil mounds further warms the soil by trapping heat and moisture underneath. **Black plastic** laid over the soil also helps to warm up garden soil but it is less effective than clear plastic. However, black plastic doesn't let in the light that weeds need to grow, while weeds thrive under clear plastic.

A **gentle south-facing slope** is the best location for a garden because the soil is warmer, better drained, and more likely to be free of permafrost than level ground. Gardens against the **south side of a house or shed** will get extra heat from reflection off the wall. In windy areas, a **wind break** around the garden will help it stay warm.

PROTECTED GARDENING

While Alaskan soils are usually cooler than ideal for plant growth, summertime air temperatures are adequate for most vegetables. Warm season crops, however, grow better when the air surrounding them (as well as the soil they are growing in) is warmed. Hot kaps, cloches, cold frames and greenhouses use the sun's energy to warm the air inside them: sunlight and warmth pass into them and get "trapped." The main reason for this is these shelters block any air movement which would blow the heat away.

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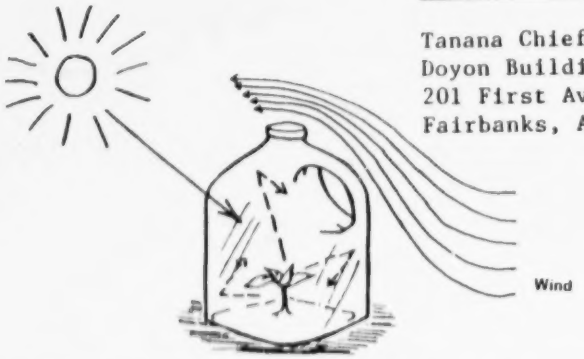


The extra warmth provided by plant shelters allows you to set transplants in the garden 1-2 weeks earlier than if no protection is used. This amount of time could be important, as our usual growing season is only 12-15 weeks long! Toward the end of the season, plant covers may prolong the gardening season by protecting vegetables from light frosts.

Cool season crops are not usually covered throughout the summer: these plants grow best when it's cool and may bolt prematurely if it's too warm. Gardeners along the coast (Zone 3), however, will find that cabbage family plants and root crops do better when grown in covered grow-boxes. Zone 3 gardens can be surrounded by fencing made of reinforced plastic which will block the cool summer breezes.

If you plan to do some protected gardening this season, keep the following in mind:

ORIENTATION

The longer side of your tunnel, cold frame or greenhouse should run in an E-W direction. This exposes more surface to the sun which passes mainly through the southern sky at our latitude. Cold frames or greenhouses can be placed against the south side of a house or shed: more heat is lost from a north wall than comes in from sunshine. Place greenhouses where there is some air movement (not windy) rather than where the air remains still.

SOILS AND FERTILIZER

If you are going to be filling grow-boxes or pots and growing beds in the greenhouse, add compost, peat, or sand to your soil to make a light, porous mix. Plain garden soil tends to pack down too tightly in containers. Plants in cold frames and greenhouses (even if you plant directly into the ground) should always be fertilized with soluble-type (like Rapid-Gro) and/or organic fertilizers. Regular garden fertilizers contain salts which will build-up in the soil over time and cause problems.

VENTILATION

High temperatures can be as harmful to plants as cold. On sunny days, it can easily get too hot in a tightly closed shelter. Moisture will also build up inside, which is favorable to mold and other plant diseases. Ventilation is as simple as tearing a small hole in hot kaps, removing the top from plastic jugs, or folding back grow-tunnel covers. It's a good idea to keep a thermometer in cold frames and greenhouses to check the temperature. Prop open cold frame lids and open up the greenhouse when the thermometer reads 80°. Greenhouses should have a vent or small window in the wall opposite the door so air can move **through** them.

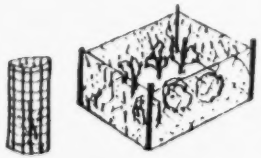
WATERING

When it's warmer, plants use more water and can wilt quickly. Check grow-boxes and greenhouses each morning or evening and water as needed. Always water thoroughly to promote deep roots and better growth.

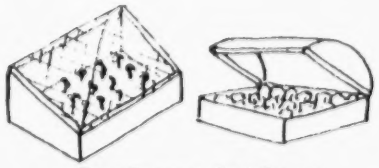
SANITATION

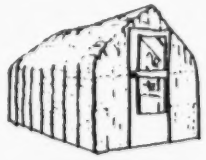
The warm, moist conditions that cause plants to thrive are also favorable for insects and plant diseases. If you notice a problem, take action at once to prevent pests or diseases from spreading. Peppers are especially attractive to aphids, so check these plants carefully. Leaves that have died or are moldy should be picked off and taken away, not left on the soil. If you use insecticides or fungicides, be sure to **read and follow all directions** and keep children and pets away during and after application.

Hotkaps


Windbreaks

Cloches or Grow-Tunnels


Grow-Boxes or Cold Frames


Greenhouses

NORTHERN LIGHTS GARDEN AND PET CENTER

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JIM & ANITA HOLM, *Owners*

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Seed Starting Schedule

NOTE: Normal last frost date is June 1st in the Fairbanks area

HOW TO USE THIS CHART: If your plants are to be transplanted outside use the "calendar" times to figure when you should start the seed, e.g., lobelia would be started March 1st - 10th

If your plants are to be transplanted into a greenhouse use the "weeks" times and count back from the date the greenhouse is to be planted, e.g., if your greenhouse is to be planted April 1st, lobelia should be started 12-14 weeks before transplanting or February 1st - 10th *KEEP RECORDS.*

March 1-10 *12-14 Weeks before transplanting*

Vegetables

Celery
Parsley
Peppers
O-S Cross Cabbage

Flowers

Lobelia
Tuberous Begonias
Petunias - for hanging baskets
Carnations - and many for Mother's Day blooming

March 10-20 *10-12 Weeks before transplanting*

Vegetables

Eggplant
Cucumbers - greenhouse
Cherry Tomatoes
Most Herbs
Greenhouse tomatoes

Flowers

Portulaca - moss rose
Pansies
Violas
Most Perenials
Ageratum
Schizanthus
Nemesia
Petunias - for garden

March 20 to April 1 *8-10 Weeks to transplanting*

Vegetables

Outside Tomatoes
Melons - greenhouse

Flowers

Seed Dahlias
Anemones
Ranunculus
Snapdragons
Alyssum
Verbena
Daisies
Poppies

April 1-10 *6-8 Weeks to transplanting*

Vegetables

Brussel Sprouts

Flowers

Zinnias
Potentila
Mimulus
Asters
Godetia
Stocks
Most Annuals
Single Marigolds
Candytuft

April 1-10 *5-6 Weeks to transplanting*

Vegetables

Cabbage
Cauliflower
Broccoli
Head Lettuce
Pumpkins

Flowers

Giant & Dwarf Marigolds
Phlox
Dwarf Zinnias
African Daises
Calendula
Larkspur
Hollyhocks
Lavatera

April 20 to May 5 *4-5 Weeks to transplanting*

Vegetables

Outside Cucumbers
Squash
Melons
Corn

Flowers

Sunflowers
Glad Bulbs
Nasturtiums
Sweet Peas
Morning Glory
Scarlet Runner Bean
Canary Bird Vine
Castor Beans
Cosmos

"OUR GREATEST SUCCESS IS YOURS"

A COMPUTER GARDEN PLAN

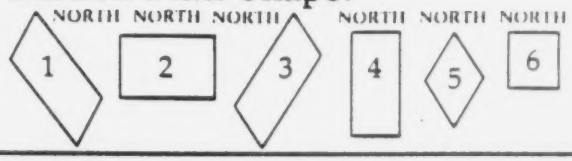
(Use this form and send to Northrup King for their computerized garden plan.)

Garden Dimensions:

_____feet by _____feet.
(More than one garden plot? Use a separate form for each.)

Largest garden that can be planned is 900 x 900 ft.
Note: Do not include space already planted in perennial crops.

Garden Plan Shape:



Here are possible garden plot shapes and orientation to the sun. Circle the number of the plot shaped most nearly like yours.

Soil Description:

1. ☐ Light colored, sandy 2. ☐ Dark, black soil 3. ☐ Clay

Check the phrase that best describes your garden soil.

Weeding Method: Check the type of cultivating you will do.

1. ☐ Hand weeding 2. ☐ Small rotary tiller 3. ☐ Medium rotary tiller 4. ☐ Large rotary tiller/small tractor

Vegetable Variety Selection:

Vegetables	Number of Adults You Wish to Feed For: Fresh Use	Canned/ Frozen Use
EXAMPLE	2	2
Asparagus	1	
Beans (pole)	2	
Beans (bush)	3	
Beans (Lima)	4	
Beets	5	
Broccoli	6	
Brussels Sprouts	*	
Cabbage	8	
*Cantaloupe	9	
Carrot	10	
Cauliflower	11	
Chard (Swiss)	12	
Collards	13	
*Corn (sweet)	14	
Cucumber (slicing)	15	
Cucumber (pickle)	16	
Dill	17*	
Eggplant	18	
Kale	19	
Kohlrabi	20	

Vegetables	Number of Adults You Wish to Feed For: Fresh Use	Canned/ Frozen Use
Lettuce (head)	21	
Lettuce (leaf)	22	
Mustard	23	
Okra	24	
Onion	25	
Parsley	26	
Peas	27	
Peas (edible pod)	28	
Pepper	29	
Potato	30	
*Pumpkin	31	
Radish	32	
Spinach	33	
Spinach (New Zealand)	34	
*Squash (winter)	35	
Squash (summer)	36	
Squash (Zucchini)	37*	
Tomato (small fruit)	38	
Tomato (standard)	39	
Turnip	40	
*Watermelon	41	

Choose your vegetables by indicating the *number* of adults you wish to feed. (See example.) Asterisked (*) varieties need large growing areas. Minimize these in a small garden.

Personal Data: (please print)

Name_____

Address_____

City_____ State_____ Zip_____

Important. Give the zip code of your garden's location if different than your home: _____

Allow 4 to 6 weeks for delivery.

Enclose $3.95 check or money order payable to Northrup King.
Mail to: Northrup King Co., Consumer Products Division, Box 1615, Minneapolis, MN 55440

NORTHRUP KING

GARDEN SEEDS

151

143

Northrup King Co.
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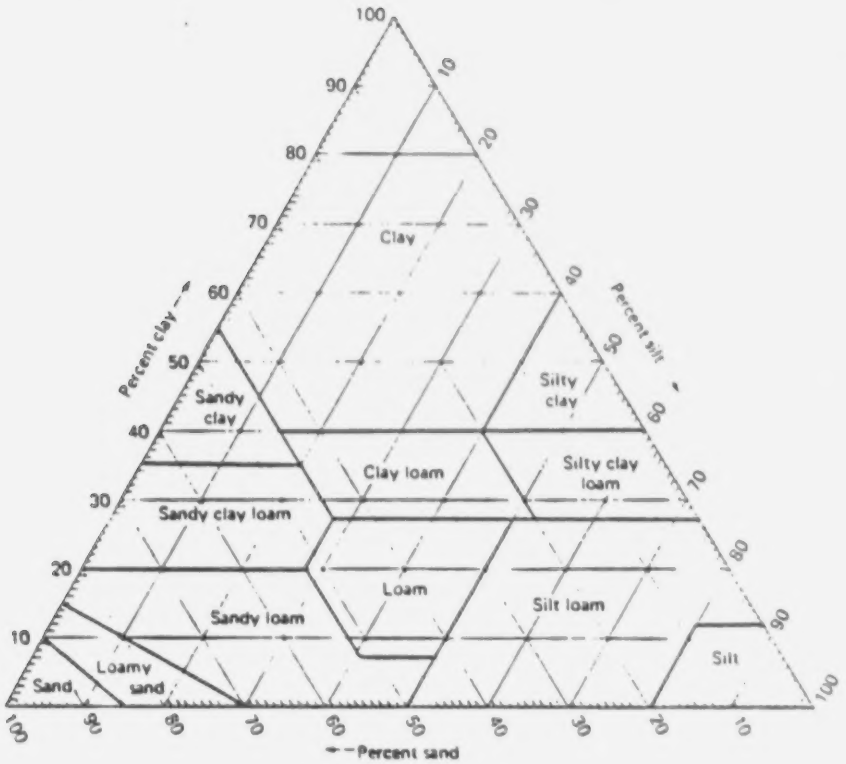


Figure 3-1 Guide for textural classification.

Fraction	Soil separate	Size, mm	"Memory aid"
Sand	Very coarse sand	2.0 –1	$2.00–$1.00
	Coarse sand	1.0 –0.5	1.00– 0.50
	Medium sand	0.5 –0.25	0.50– 0.25
	Fine sand	0.25–0.10	0.25– 0.10
	Very fine sand	0.10–0.05	0.10– 0.05
Silt	Silt	0.05–0.002	
Clay	Clay	Below 0.002	

* These size limits are used by the U.S. Department of Agriculture. Certain other organizations use different size limits for soil separates. For example, the International Society of Soil Science divides the separates as follows: coarse sand, 2.0 to 0.2 mm; fine sand, 0.2 to 0.02 mm; silt, 0.02 to 0.002 mm; and clay, below 0.002 mm.

Soils and Soil Fertility,
4th Ed., 1978

Louis Thompson and
Frederick Troeh
McGraw-Hill Book Co.

15.

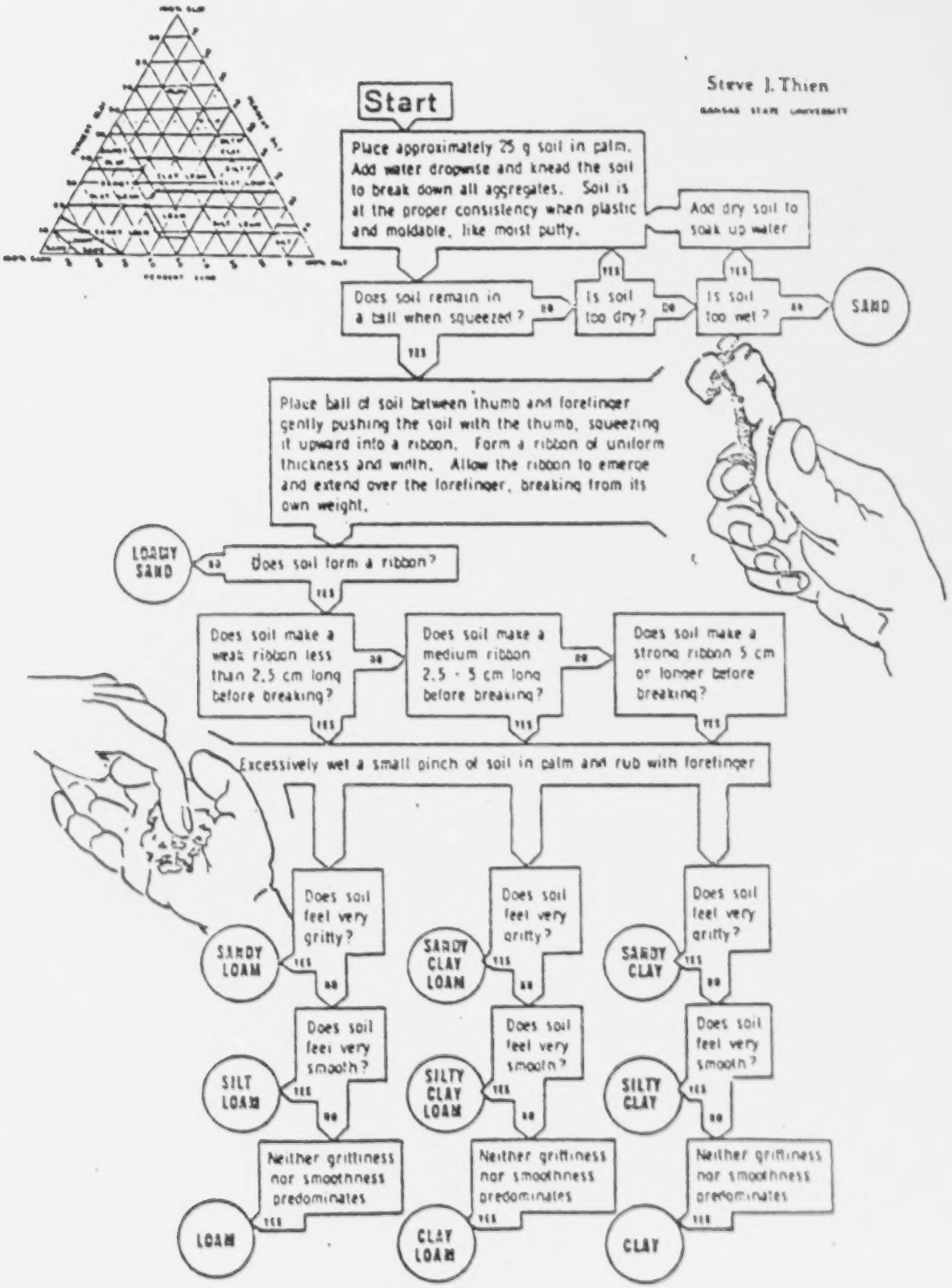

Steve J. Thien
Start
Place approximately 25 g soil in palm. Add water dropwise and knead the soil to break down all aggregates. Soil is at the proper consistency when plastic and moldable, like moist putty.
Add dry soil to soak up water
Does soil remain in a ball when squeezed?
Is soil too dry?
Is soil too wet?
SAND
Place ball of soil between thumb and forefinger gently pushing the soil with the thumb, squeezing it upward into a ribbon. Form a ribbon of uniform thickness and width. Allow the ribbon to emerge and extend over the forefinger, breaking from its own weight.
LOAMY SAND
Does soil form a ribbon?
Does soil make a weak ribbon less than 2.5 cm long before breaking?
Does soil make a medium ribbon 2.5 - 5 cm long before breaking?
Does soil make a strong ribbon 5 cm or longer before breaking?
Excessively wet a small pinch of soil in palm and rub with forefinger
Does soil feel very gritty?
SANDY LOAM
SANDY CLAY LOAM
SANDY CLAY
Does soil feel very smooth?
SILT LOAM
SILTY CLAY LOAM
SILTY CLAY
Neither grittiness nor smoothness predominates
LOAM
CLAY LOAM
CLAY

Figure 2-3. Determining soil texture by the "feel method."

HINTS FOR HAND TEXTURING OF SOILS

Use the following key as a guide:

I. Can see or feel individual sand grains

Squeezed when moist it forms a cast that:

a. crumbles at a touch ---------- SAND
(Squeezed when dry it falls apart when pressure is released)

b. bears carefull handling ---------- SANDY LOAM
(Squeezed when dry it forms a week cast that crumbles at a light touch)

c. bears moderately rough or rough handling

1) forms a rough broken ribbon between thumb and finger ---------- LOAM
(Wet cast can be deformed slightly without crumbling. Dry cast bears carefull handling)

2) forms a thin, smooth slick ribbon that will bear its own weight ---------- CLAY LOAM
(Wet cast can be molded into different shapes but tends to break as moisture is worked out)

II. Cannot see or feel individual sand grains

Moist soil forms a cost that bears handling. When "pinched":

a. Forms a rough broken ribbon that will not bear its own weight ---------- SILT LOAM
(Dry cast may be handled freely. Dry material feels like flour)

b. Forms a thin smooth ribbon

1) ribbon just bears its own weight ---------- SILT LOAM
(Wet cast can be kneaded into different shapes but with a tendency to crack as moisture is worked out)

2) thin ribbon easily bears its own weight ---------- SILTY CLAY or CLAY
(Wet cast can be molded into different shapes without breaking)

NOTES

Table 1—Field criteria used in determining major textural classes*

Soil textural class	Feel (moist)	Field characteristics: Ability to form stable ball	Ability to ribbon out	"Soapy" feels	Plastic	Sticky	Consistence: Moist	Consistence: Dry
Sand	Very gritty	No	No	No	No	No	Loose	Loose
Loamy sand	Very gritty	No	No	Yes (slight)	No	No	Loose	Loose
Sandy loam	Gritty	Yes (easily deformed)	Yes (dull surface; poorly formed)	Yes	No	No	V. friable	Soft
Loam	Gritty	Yes	Yes (dull surface; poorly formed)	Yes	Yes (slight)	Yes (slight to mod.)	Friable	Soft
Silt loam	Velvety	Yes	Yes (dull surface, poorly formed)	Yes	Yes (slight to mod.)	Yes (slight to mod.)	Friable	Soft
Silt, clay loam	Velvety and sticky	Yes (very stable)	Yes (shiny surface; well formed)	Yes	Yes (mod.)	Yes	Friable to firm	Slightly hard
Clay loam	Gritty and sticky	Yes (very stable)	Yes (shiny surface; well formed)	Yes	Yes (mod.)	Yes	Firm	Slightly hard to hard
Sandy clay loam	Very gritty and sticky	Yes (very stable)	Yes (well formed; shiny surface)	Yes	Yes (mod.)	Yes	Friable to firm	Slightly hard to hard
Silty clay	Extremely sticky and very smooth	Yes (very resistant to molding)	Yes (well formed; very shiny surface)	Yes	Yes (strong)	Yes (very sticky)	Firm to extremely firm	Hard to very hard
Clay	Extremely sticky with slight greasiness	Yes (very resistant to molding)	Yes (well formed; very shiny surface)	Yes	Yes (strong)	Yes (very sticky)	Firm to extremely firm	Hard to very hard

* These criteria can be used as a "general guide" to determine field textures, but local variations in organic matter content, clay mineralogy, parent material, and other factors would require adjustments before their use in a given area.

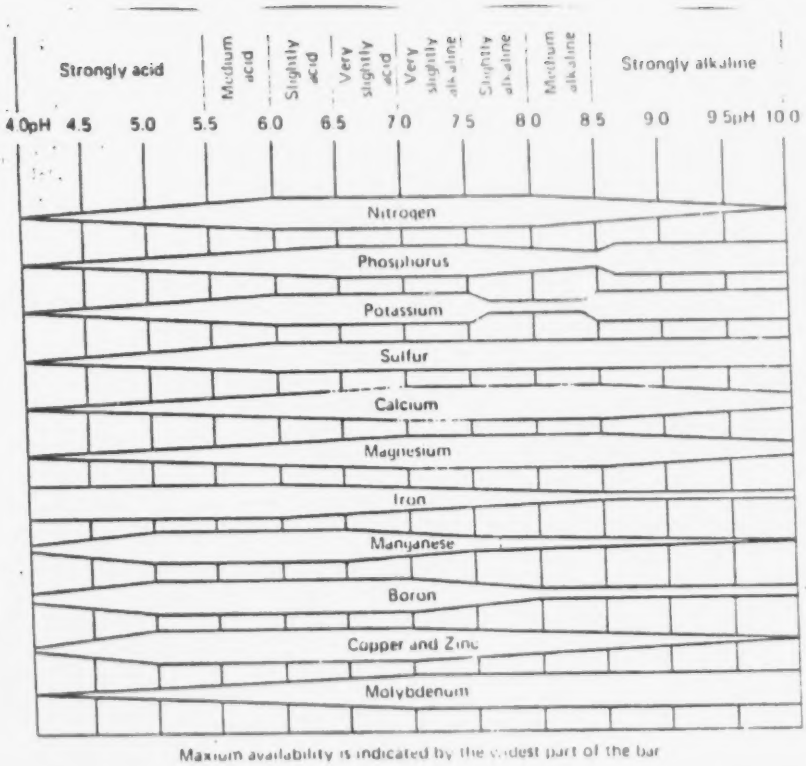


Figure 7-5 A schematic illustration of the relation between plant nutrient availability and soil reaction. (*After Truog.* 1946.)

Soils and Soil Fertility,
4th Ed., 1978

Louis Thompson and
Frederick Troeh
McGraw-Hill Book Co.

SUPPLY AND AVAILABILITY OF PLANT NUTRIENTS

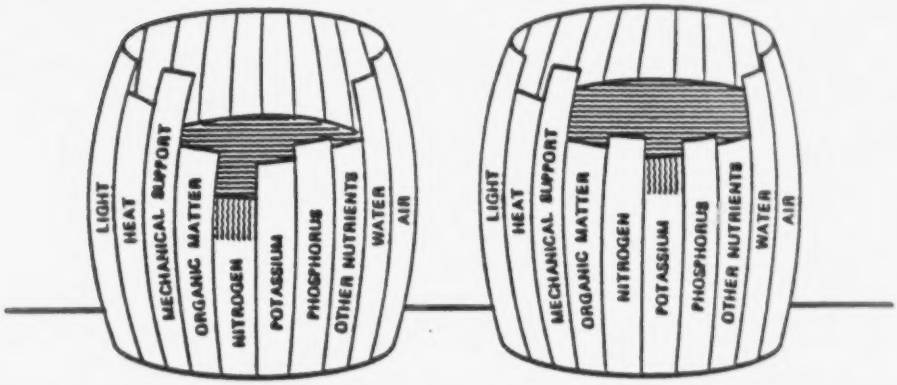
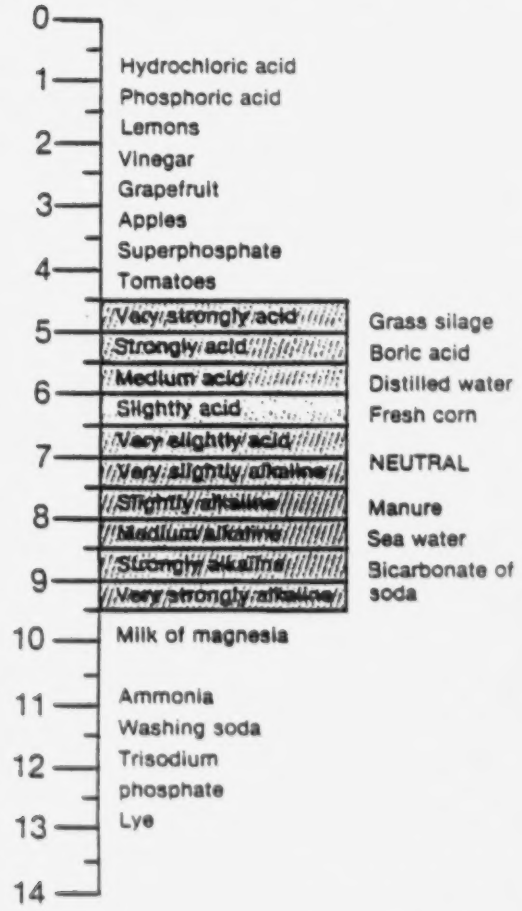


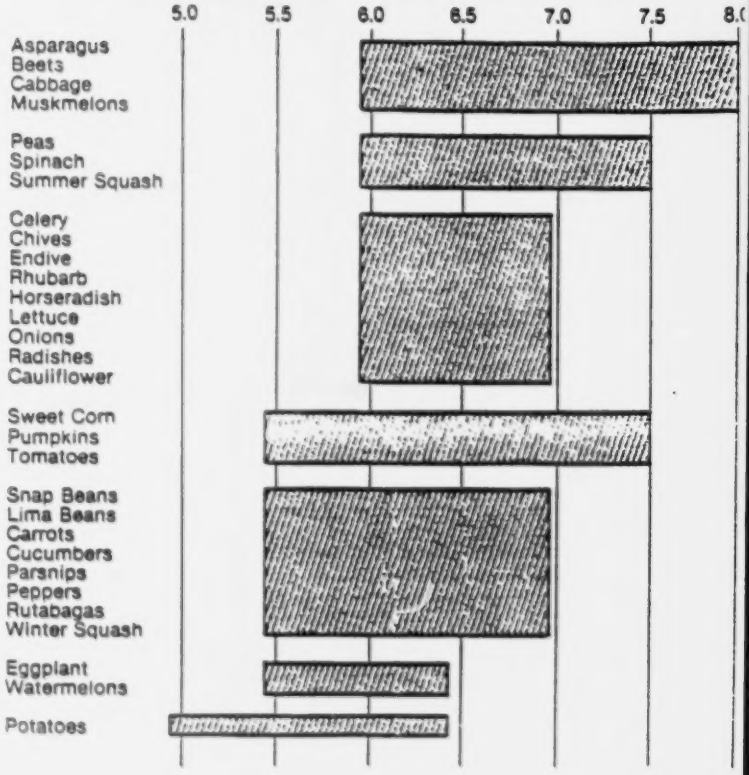
FIGURE 2:1. An illustration of the principle of limiting factors. The level of water in the barrels above represents the level of crop production. (*Left*) Nitrogen is represented as being the factor that is most limiting. Even though the other elements are present in more adequate amounts, crop production can be no higher than that allowed by the nitrogen. When nitrogen is added (*right*) the level of crop production is raised until it is controlled by the next most limiting factor, in this case, potassium.

The Nature and
Properties of Soils
8th Edition
Nyle C. Brady

pH SCALE



OPTIMUM pH RANGE FOR VEGETABLE CROPS



TO RAISE SOIL ONE UNIT OF pH

	Hydrated Lime	Dolomite	Ground Limestone
Light Soil 100 sq. ft.	1½ pounds	2 pounds	2½ pounds
Heavy Soil 100 sq. ft.	3½ pounds	5½ pounds	6 pounds

TO LOWER SOIL ONE UNIT OF pH

	Sulfur	Aluminum Sulphate	Iron Sulphate
Light Soil 100 sq. ft.	½ pound	2½ pounds	3 pounds
Heavy Soil 100 sq. ft.	2 pounds	6½ pounds	7½ pounds

Note: The amount of lime you use doesn't have to be as precisely measured as this chart suggests.

Joy of Gardening, 1982

By Dick Raymond
Garden Way Inc.
Troy, New York 12180

EXAMPLE OF CALCULATING FERTILIZER RATE

If given: add-----N per acre
or-----P_2O_5 per acre
or-----K_2O per acre

Figure as in the following example:

Example: for a lawn, 100 feet x 100 feet
- need to add 100 lbs N/acre
- using ammonium nitrate (34-0-0)

To figure how many pounds of ammonium nitrate fertilizer needed for the lawn:

$$\frac{100 \text{ lbs N.}}{.34} = 294 \text{ lbs. ammounium nitrate/acre}$$

100' x 100' = 10,0000 square feet
1 acre = 43,560 square feet

$$\frac{10,000}{43,560} = 0.23 \text{ acre}$$

.23 x 294 lbs. = 68 lbs. ammonium nitrate needed for the lawn

Use the same process for P_2O_5 or K_2O

Analysis of Organic Fertilizers

This chart shows how the content of a fertilizer is analyzed to determine the percentage of three major soil nutrients: nitrogen (N), phosphorus (P) and potassium (K), listed in the formula N - P - K. In fertilizer, phosphorus is present in the compound P_2O_5 and potassium in the compound K_2O

Organic materials	Analysis	Applications
Livestock manure & bedding	.5 to 2 - .1 to .8 - .4 to 1.0	Excellent fertilizer and soil conditioner. See chart on specific values from different animals. Apply rotted manure to good soil at 5 pounds per square yard (12 tons per acre), double that as an initial application on poor soil. Use as manure tea throughout the season
Sewage sludge (dry) (i.e. Milorganite)	.7 to 5.1 - 1.1 to 6.1 - .2 to 1.1	Human wastes treated to kill pathogens and commercially prepared sewage sludge may still contain harmful amounts of heavy metals. If certified safe in this respect, use in place of any high-nitrogen fertilizer. Otherwise, use only on lawns and flowers
Compost	.5 to 3.5 - .5 to 1 - 1 to 2	Apply freely where most needed, year-round
Bone meal (steamed)	0 to 4 - 11 to 26 - 0	Apply sparingly to compost pile or as side-dressing if soil test indicates lack of phosphorus. One pound of bone meal per 100 square feet is usually adequate
Cottonseed meal (dry)	6 - 2.5 - 1.7	Expensive, seldom available in Canada. Apply sparingly as side-dressing
Dried blood	12 - 1.5 - .57	Expensive and very rich in nitrogen. Use sparingly in compost or as side-dressing
Fish emulsion	5 - 2 - 2	Rich in micronutrients. Dilute and apply as foliar (leaf) spray or fertilizer throughout season according to need
Sawdust & wood shavings	.4 - .3 - .7	Use in garden pathways or sparingly in the compost pile
Straw	.5 - .2 - .1	Use as mulch or as an ingredient in the compost pile
Natural Deposits		
Wood ashes	0 - 1 to 2 - 3 to 7	Use only if soil test indicates acidic soil, lack of calcium. Substitute double the rate recommended for crushed limestone
Colloidal phosphate	0 - 25 - 0	Use only if soil test indicates lack of phosphorus
Rock phosphate	0 - 20 to 30 - 0	Use only if soil test indicates lack of phosphorus
Granite meal or dust	0 - 0 - 3.5	Apply only where soil test indicates lack of potassium. Also contains trace minerals
Greensand	0 - 1.35 - 4 to 9.5	Sea floor deposit containing many trace minerals. Mix with high-nitrogen fertilizer as compost additive

Harrowsmith Northern Gardener
1982
By Jennifer Bennett
Canden House Publishing Ltd.
Queen Victoria Road
Candan East, Ontario
Canada. KOK 1JO

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Alaska Gardener's Alamanac, 1985

Tanana Chiefs Conference, Inc.
Doyon Building
201 First Avenue
Fairbanks, Alaska 99701

COMPOSTING

Another word for compost is **humus.** Compost or humus is decayed plant and animal residues. If you dig down below the moss layer in the forest or out on the tundra you will find dark-colored humus. Microorganisms in the soil break down fresh plant and animal parts into compost which greatly improves the garden soil it is added to. Compost contains plant nutrients and it helps the soil hold both the water and air that plant roots need for growth.

You can make compost for your garden from weeds and thinnings, leaves, kitchen scraps – almost anything that rots. (Regular household garbage, which contains metal, plastic and glass, **should not** be used for compost.) It takes **1-2 years** for compost to form from the raw materials. By providing favorable conditions for the decay organisms, the composting will go faster:

AERATION

Decay organisms need air, so support the compost heap on branches or a chicken wire platform and pile materials loosely. Piles should be **3-3½ feet high:** if built taller they tend to mash down and leave less room for air. Turning the pile adds air as well as helps make sure all the materials are broken down.

CARBON TO NITROGEN RATIO

Like other living things, the decomposing organisms work best with a **balanced diet.** Most composting materials are either mostly carbon (carbohydrate = energy) or high in nitrogen (activator). Be sure to add a mix of these ingredients to your pile:

High in Carbon	**High in Nitrogen**
dead leaves and grass	tender, young grass or weeds
sawdust	manure*
garden plant refuse	fish or blood meal
shredded newspaper	caribou stomachs and fish scraps †

Sprinkle some commercial fertilizer, wood ashes, bone meal, lime and/or crushed egg shells every couple of layers to help get the pile working and to increase its fertilizer value.

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*Dog manure may contain parasites harmful to humans. Be sure to compost it at least two years.
†Don't put fat, large chunks of meat, or bones in the pile: dogs will try to dig that up. Boiling fish scraps first will reduce their odor.

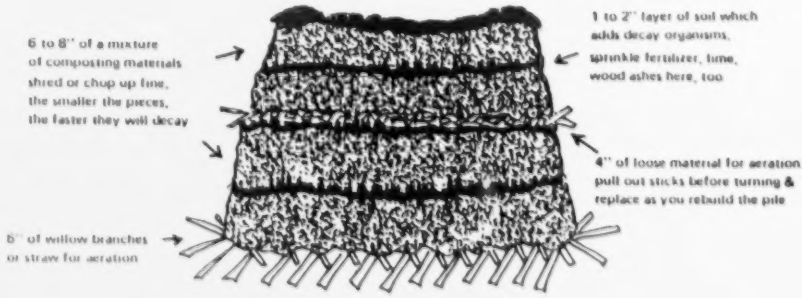
MOISTURE

As you build a compost pile, sprinkle water on each layer to thoroughly moisten it. Make the top of the pile dish-shaped so more rain will soak into the pile. If it's been dry, pour water into this depression to keep the heap moist.

HEAT

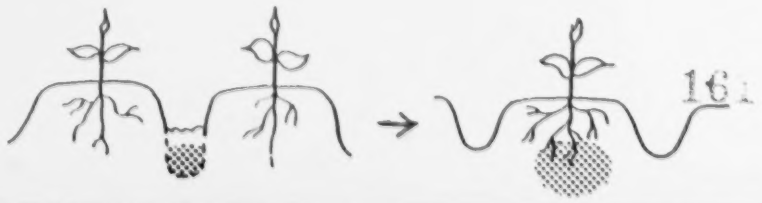
Once the pile begins to decay, it will heat up. The pile should be large enough to hold this heat: **3-4 feet across and 3 feet high** is the best size. You can help the pile heat up by covering it with clear plastic. Be sure the pile is **thoroughly wetted** before you cover it up.

A COMPOST PILE


6 to 8" of a mixture of composting materials shred or chop up fine, the smaller the pieces, the faster they will decay
1 to 2" layer of soil which adds decay organisms, sprinkle fertilizer, lime, wood ashes here, too
4" of loose material for aeration pull out sticks before turning & replace as you rebuild the pile
6" of willow branches or straw for aeration

TRENCH COMPOSTING

Another way to add compost is to bury fresh organic material directly in the garden. Dig a trench about 6 inches deep between rows. Place residue (as with regular composting, a mix of materials works best) in a 3-4 inch layer at the bottom and cover with the soil you dug out. Next season, build your raised mounds over the compost and start new trenches for residues.



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THE COMPOSTING C/N RATIO

* * * * * * * * * * * *

25 : 1
CARBON : NITROGEN

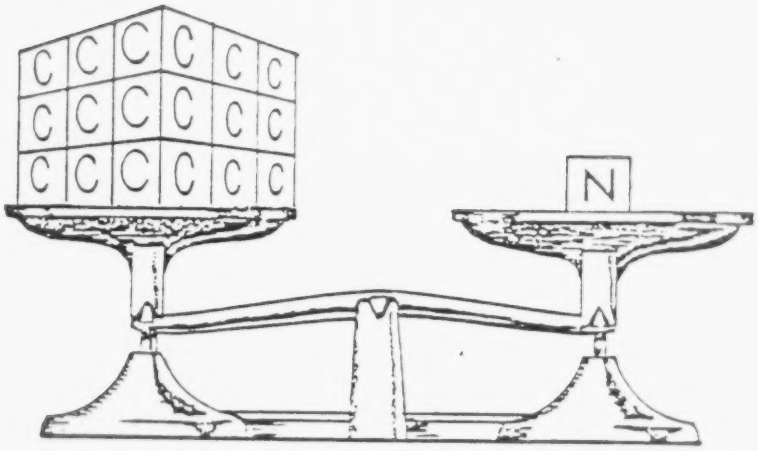

Illustration From: Let It Rot, 1975
By Stu Campbell
Garden Way Publishing
Charlotte, Vermont 05445

MATERIALS HIGH IN CARBON

- dry grass clippings
- leaves
- sawdust
- vegetable trimmings

MATERIALS HIGH IN NITROGEN

- manure
- bloodmeal
- fresh grass clippings

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* For practical purposes, this ratio need not be exact.

INGREDIENTS

ACTIVATORS:

- RICH SOIL
- MANURE (AVOID USING DOG MANURE)
- DRY DOG FOOD
- BONE OR BLOOD MEAL
- HOOF OR HORN MEAL
- ALFALFA MEAL
- SOYBEAN MEAL
- COTTONSEED MEAL

ORGANIC MATERIALS:

COARSE MATERIAL:

- WEEDS & PLANT STALKS
- LEAVES
- GRASS CLIPPINGS
- HAY
- PEAT MOSS
- SAWDUST
- UNPRINTED PAPER OR CARDBOARD

GARBAGE:

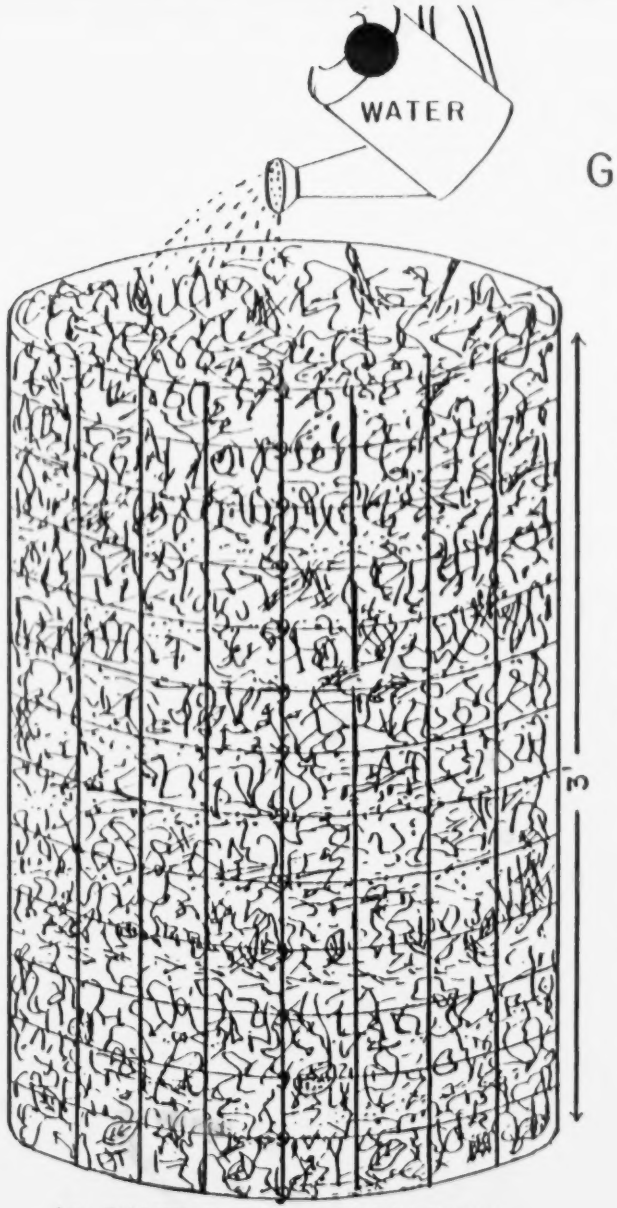
- FRUIT & VEGETABLE WASTES
- EGGSHELLS
- COFFEE GROUNDS
- PEANUT SHELLS, ETC.

AVOID:

- MEAT SCRAPS, BONES, FAT, OR GREASE WHERE DOGS OR OTHER ANIMALS ARE A PROBLEM

DO NOT USE !!

PLASTICS, GLASS, METAL, CHARCOAL



AN EXAMPLE OF A COMPOST BIN MADE FROM CHICKEN WIRE (3'x 9') ENDS OF WIRE WERE FASTENED TOGETHER TO MAKE A CIRCULAR CAGE

COMPOSTING

GENERAL DIRECTIONS

1. COLLECT ORGANIC MATERIALS.
2. BUILD COMPOST BIN.
3. PUT SOME COARSE MATERIAL IN BOTTOM OF BIN.
4. SPRINKLE ON SOME ACTIVATOR.
5. SPRINKLE LIGHTLY WITH WATER UNTIL PILE IS LIKE A DAMP SPONGE.
6. ADD SOME DIFFERENT ORGANIC MATERIALS.
7. SPRINKLE ON MORE ACTIVATOR & MORE WATER.
8. CONTINUE BUILDING LAYERS UNTIL CONTAINER IS FULL. (THIS CAN BE DONE ALL AT ONCE, OR GRADUALLY AS MATERIALS BECOME AVAILABLE)
9. FOR FASTER COMPOST, TURN PILE EVERY OTHER DAY. A CLEAR PLASTIC COVER ON COMPOST WILL HELP IT TO HEAT UP AS WOULD PUTTING THE BIN IN AN UNUSED CORNER OF A GREENHOUSE.

Tanana Chiefs Conference, Inc.
Agriculture Department

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CHAPTER II

Common Food Garden Plant Families and How to Rotate Them

Family name	Family members	Rotation
Chenopodiaceae *(the beet family)*	Vegetables: beets, Swiss chard, spinach, Malabar spinach and tampala	Of medium height, these plants will rotate with others in the garden's mid-range: Cruciferae, Leguminosae, Liliaceae, Solanaceae
Compositae *(the sunflower family)*	Vegetables: globe and Jerusalem artichokes, sunflowers, endive, cardoon, escarole, lettuce, salsify, chicory, dandelion Flowers: daisies, zinnias, dahlias, marigolds, asters, chrysanthemums Herbs: yarrow, camomile, tarragon (perennial)	Jerusalem artichokes are perennial and so will not be rotated. Rotate sunflowers with staked peas or pole beans. Leafy Compositae are best rotated with Cucurbitaceae, Leguminosae, Liliaceae, Solanaceae, Umbelliferae. Interplant and rotate marigolds with tomatoes
Convolvulaceae *(the morning glory family)*	Vegetables: sweet potatoes Flowers: morning glories	Sweet potatoes are grown only as a novelty in most areas. Plant in full sun. Morning glories may be interplanted with climbing peas, beans, Cucurbitaceae
Cruciferae *(the mustard family)*	Vegetables: broccoli, Brussels sprouts, cabbage, Chinese cabbage, cauliflower, kale, kohlrabi, mustard greens, radish, rutabaga, turnip, cress, watercress Flowers: alyssum Herbs: horseradish (perennial)	Watercress needs a very wet spot where it will grow every year. Rotate all others with members of other families that grow to about the same size (mid-range) – bush beans and onions, for example
Cucurbitaceae *(the gourd family)*	Vegetables: summer and winter squash, pumpkins, melons, cucumbers, gourds	If staked, rotate with staked tomatoes, pole beans, sunflowers, peas. If allowed to sprawl, rotate with other space-demanding crops, such as potatoes, or other low-growing crops such as leafy Compositae
Graminae *(the corn family)*	Vegetables: corn	One of the garden's hungriest crops, corn should be rotated with legumes whenever possible
Leguminosae *(the pea family)*	Vegetables: beans, peas, lentils, peanuts Flowers: sweet peas, lupines	Although they will grow happily in the same spot for several years in succession, their nitrogen-adding properties make them valuable in rotation with all other families
Liliaceae *(the lily family)*	Vegetables: asparagus (perennial), onions, garlic, leeks, shallots Flowers: lilies (perennial) Herbs: chives (perennial)	Asparagus is perennial and so does not rotate as is also true of perennial onions. All others are valuable in rotations and interplannings with all other families (as long as they are not overly shaded) as they have few pests and may help repel pests from other plants
Solanaceae *(the nightshade family)*	Vegetables: eggplant, peppers, tomatoes, garden huckleberries, ground cherries, tomatillos, potatoes Flowers: nicotiana, petunia	Quite susceptible to fungus diseases and nematodes, members should not be next-door neighbours and should follow other families of similar mid-range height in rotations
Umbelliferae *(the parsley family)*	Vegetables: carrot, celery, celeriac, parsnips Herbs: parsley, dill, fennel, lovage (perennial), chervil, caraway, anise, coriander	Deep-rooted plants that help break up soil; interplant and rotate with leafy or fruiting crops of other families, lettuce and tomatoes, for example

Harrowsmith Northern Gardener
1982
By Jennifer Bennett
Canden House Publishing Ltd.
Queen Victoria Road
Candan East, Ontario

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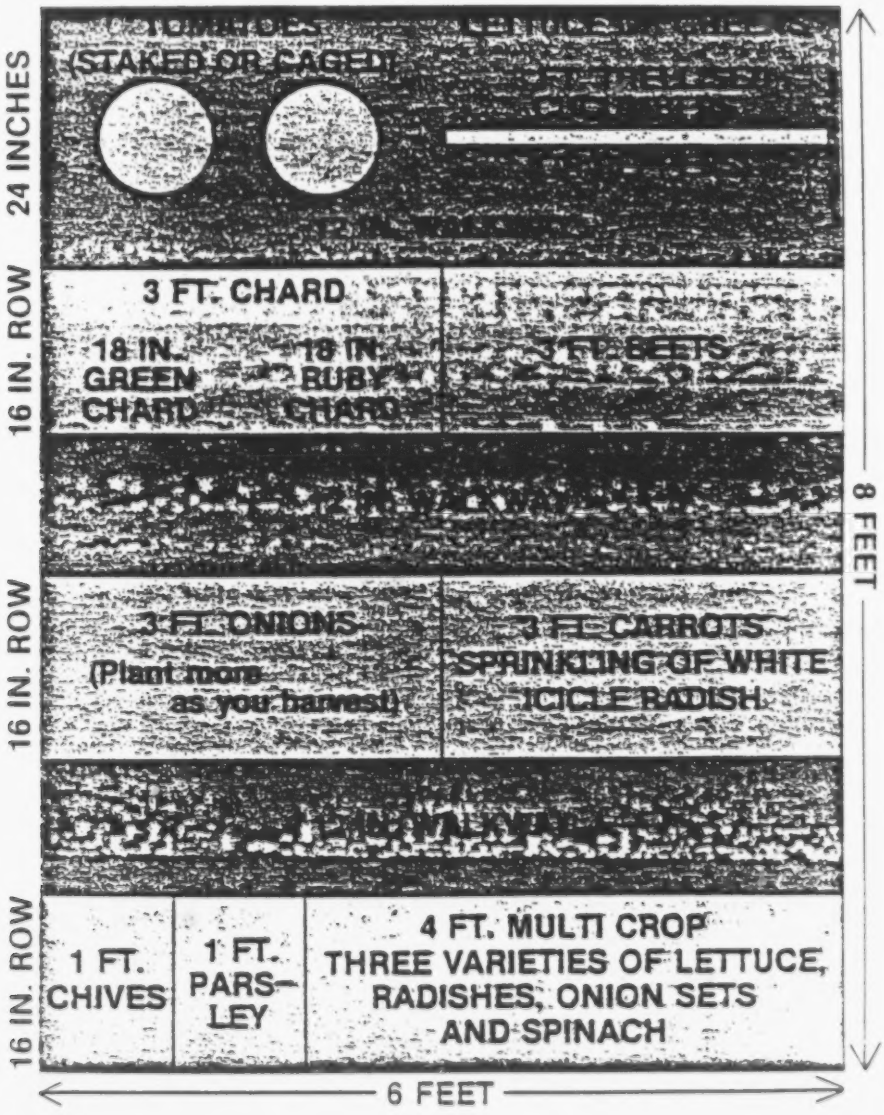
Salad Garden Plan

This is a super-productive small space garden—and it's easy to plant and care for. My vegetable selections for this garden are further explained on the next pages, but don't limit yourself to them. If you don't like the chives and parsley in Row 1, for example, fill in with something different. Be sure to plant in wide rows—that's what makes this garden so good.



Joy of Gardening, 1982

By Dick Raymond
Garden Way Inc.
Troy, New York 12180

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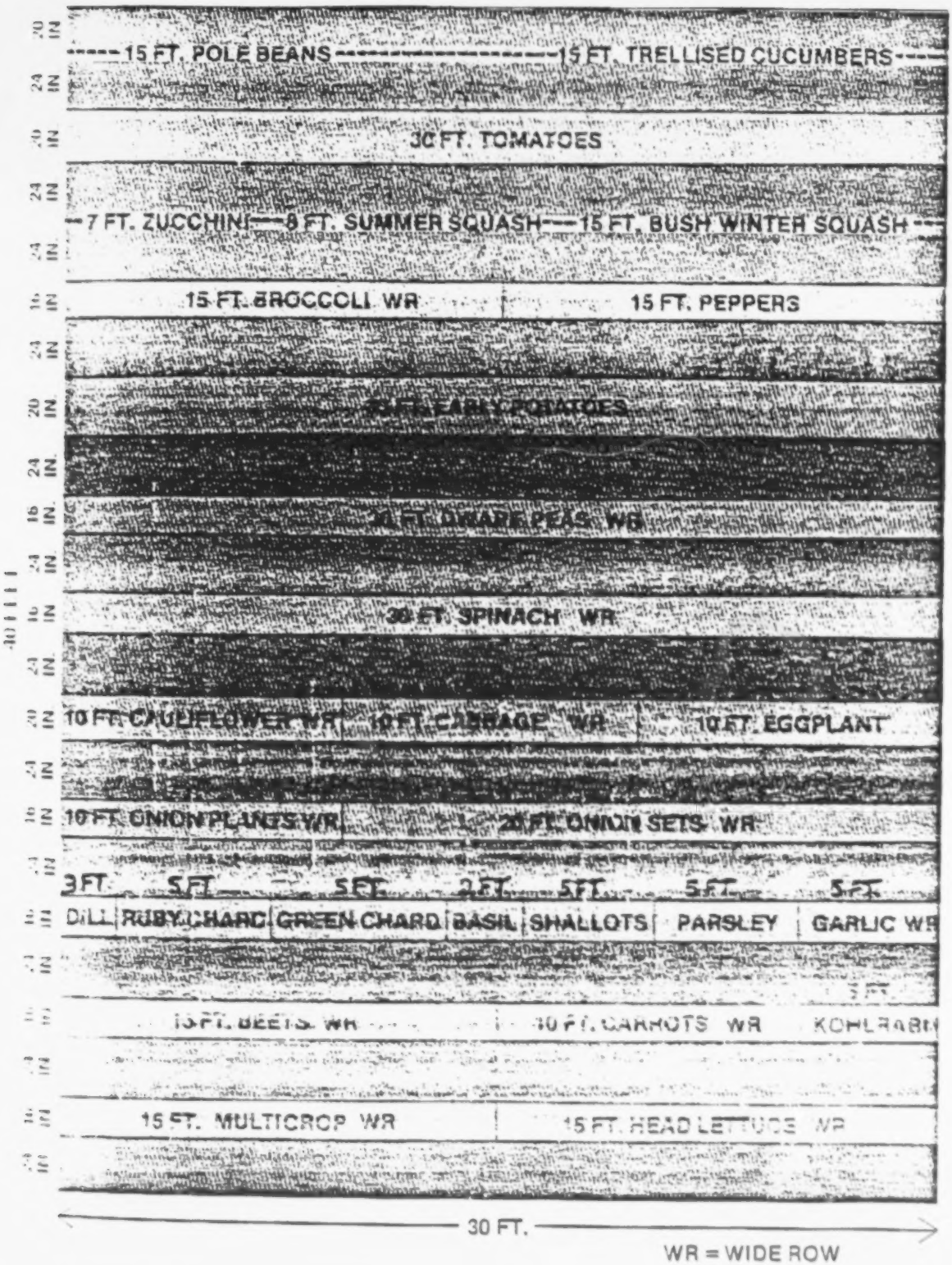
Summer Garden Plan



Joy of Gardening, 1982

By Dick Raymond
Garden Way Inc.
Troy, New York 12180

A bread knife for harvesting greens

Here's the first harvest in part of a spinach row. Note how the spinach on the left grows back from a crew cut harvest.

Greens which can be harvested by my crew cut method	Greens to be harvested by picking outside leaves or branches only
Chard	Celery
Endive	Collards
Lettuce	Kale
Mustard	New Zealand spinach
Spinach	

Joy of Gardening, 1982

By Dick Raymond
Garden Way Inc.
Troy, New York 12180

RECORD KEEPING CHART

Location _____ Date _____

Type of Food	Quantity	Time		Weather
		In	Out	

Details of Food Preparation:

Remarks on Results:

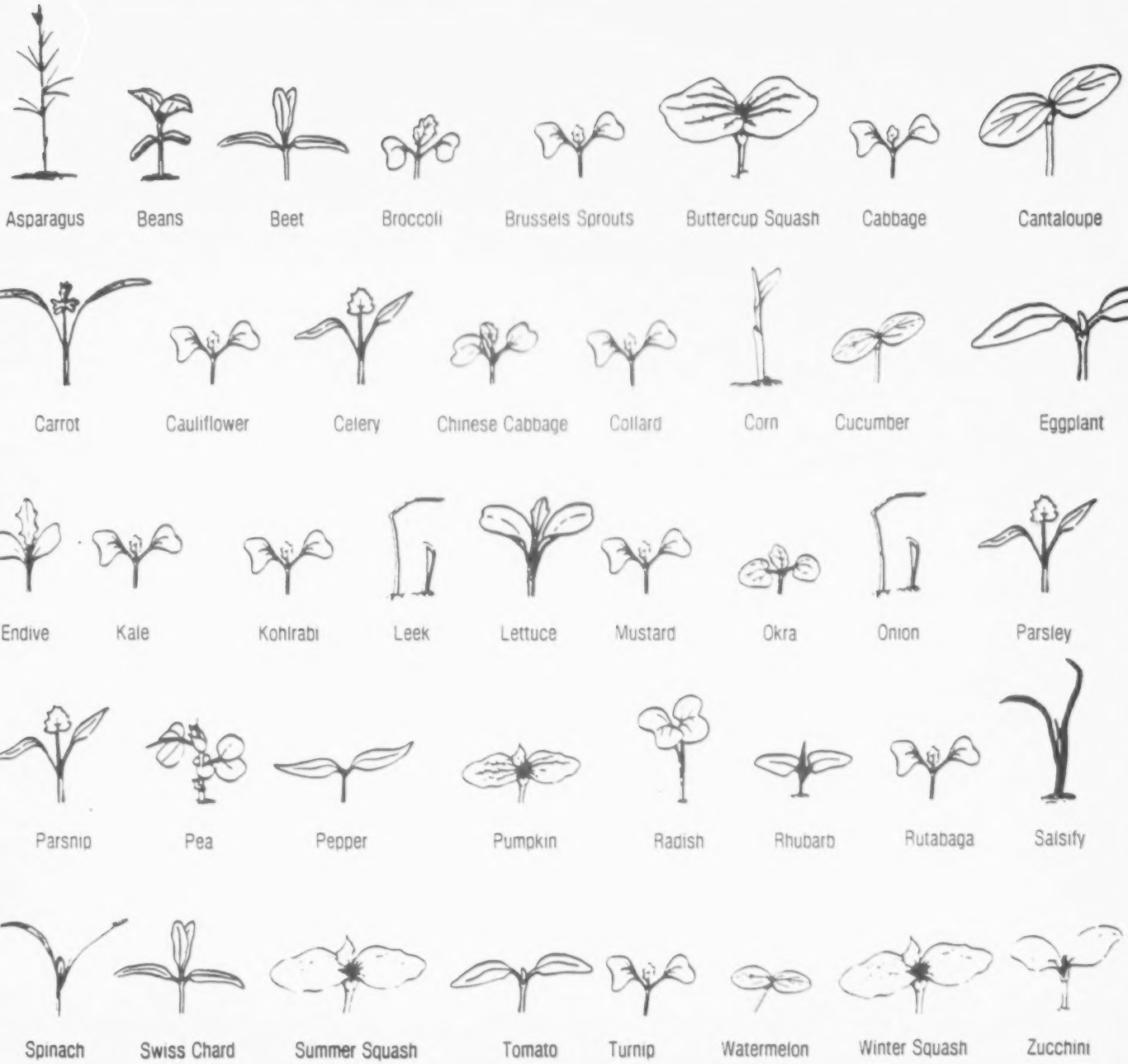
The Solar Food Dryer Book, 1978
By Stella Andrassy
Morgan & Morgan
Dubbs Ferry, NY

Often gardeners, regardless of their age or experience, are puzzled by the tiny seedlings which seem to erupt all at once each spring. Which are flowers or vegetables and which are weeds? Here are illustrations of the most common vegetable and flower seedlings to help you identify them. You'll also find seedling drawings on each Northrup King seed packet. Take this reference with you into the garden when you weed and thin your planting.

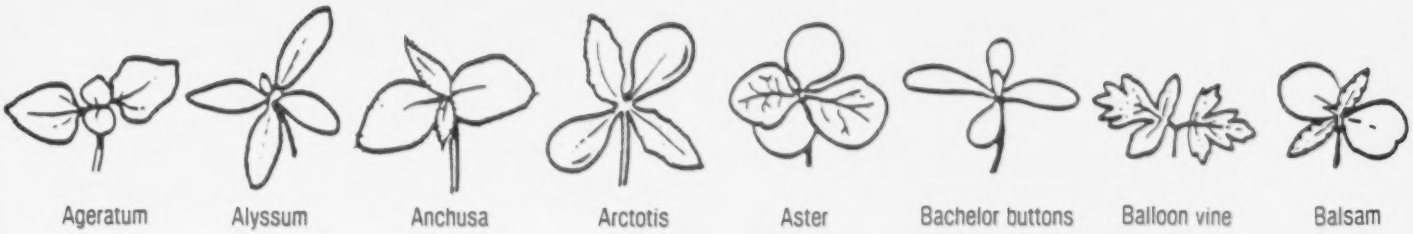
(Source: Northrup King Co., Consumer Products Division)

41 VEGETABLE SEEDLINGS

For Quick Recognition



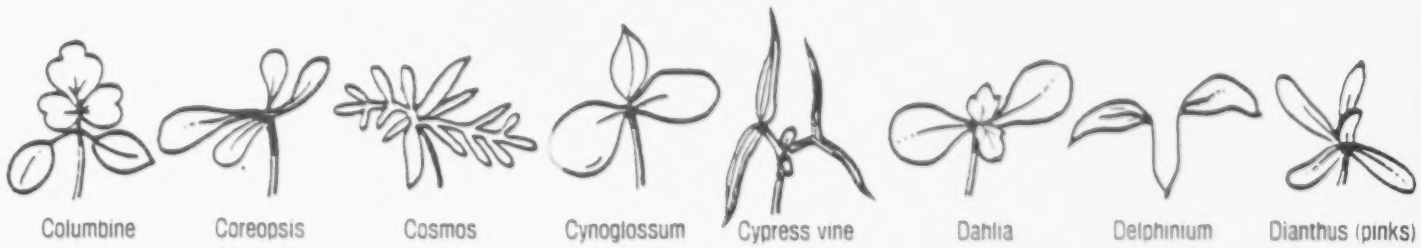
80 FLOWER SEEDLINGS
For Quick Recognition



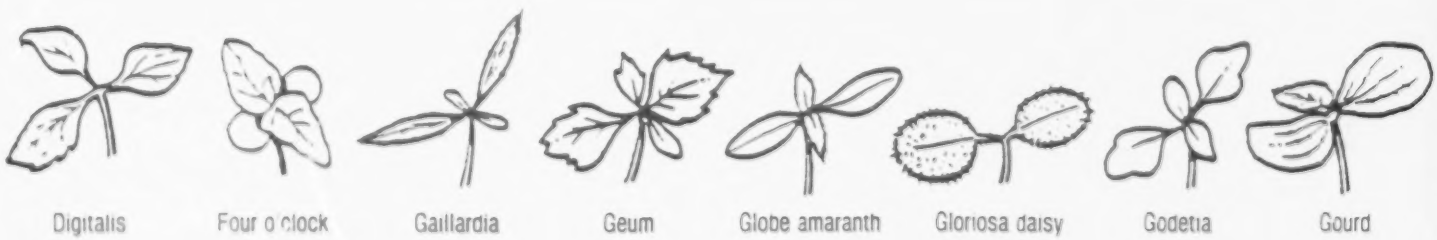
Ageratum Alyssum Anchusa Arctotis Aster Bachelor buttons Balloon vine Balsam

Balsam apple Bells of Ireland Black eyed susan Blue lace flower Calliopsis Calendula California poppy Canary bird vine

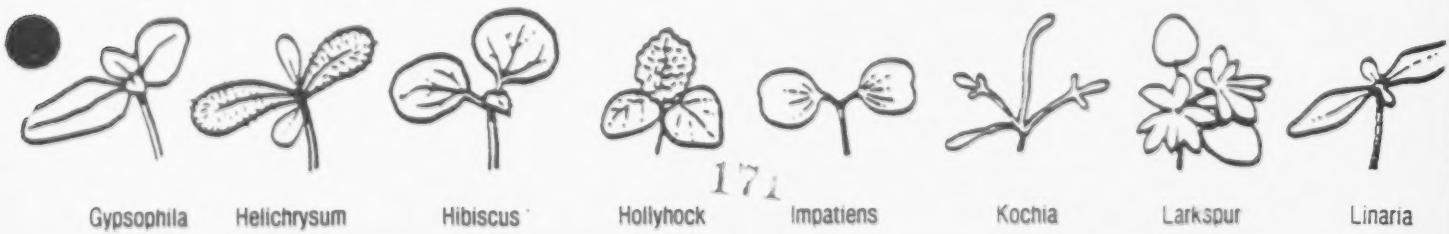
Candytuft Canterbury bells Carnation Celosia Chrysanthemum Clarkia Cleome Coleus



Columbine Coreopsis Cosmos Cynoglossum Cypress vine Dahlia Delphinium Dianthus (pinks)

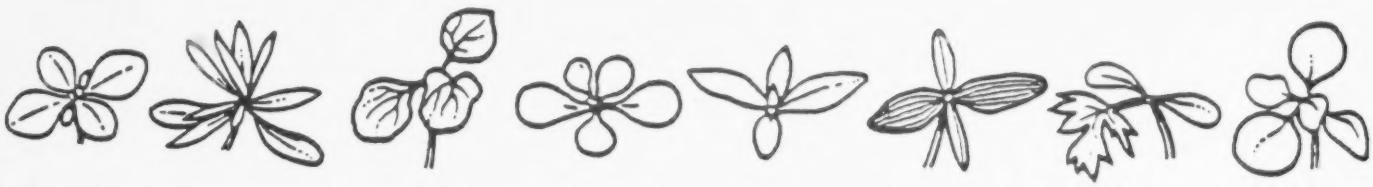


Digitalis Four o clock Gaillardia Geum Globe amaranth Gloriosa daisy Godetia Gourd



Gypsophila Helichrysum Hibiscus Hollyhock Impatiens Kochia Larkspur Linaria

Lobelia Lupine Marigold Mignonette Moonflower Morning glory Nasturtium Nemesia



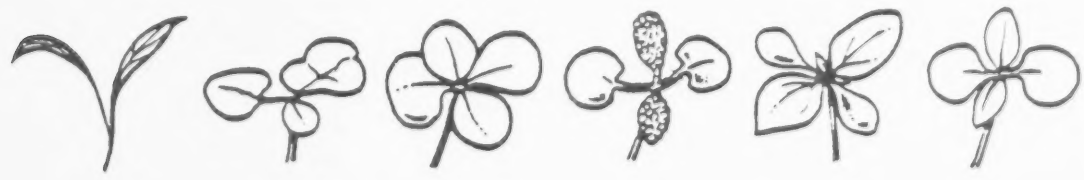
Nicotiana Nierembergia Pansy Petunia Phlox Portulaca Pyrethrum Salpiglossis

Salvia Scabiosa Scarlet runner bean Shasta daisy Shirley poppy Schizanthus Snapdragon Stock

Sunflower Sweet pea Sweet william Tithonia Verbena Vinca Wallflower Zinnia

13 HERB SEEDLINGS
For Quick Recognition

Basil Borage Catnip Chervil Chives Coriander Dill



Fennel Hyssop Marjoram Sage Summer savory Thyme

SOURCES OF ADDITIONAL INFORMATION

LOCAL CONTACTS FOR INFORMATION ON ALASKAN AGRICULTURE

District Extension Offices

Cooperative Extension Service 2651 Providence Avenue Anchorage, Alaska 99508-4670	Phone 786-1080
Cooperative Extension Service Box 556 Bethel, Alaska 99559	Phone 543-2503
Cooperative Extension Service Box 1779 Soldotna, Alaska 99669	Phone 262-5824 262-5825
Cooperative Extension Service Box 195 Homer, Alaska 99603	Phone 235-8178
Cooperative Extension Service Box 869 Palmer, Alaska 99645	Phone 745-3360
Cooperative Extension Service Box 400 Nome, Alaska 99762	Phone 443-2320
Cooperative Extension Service Box 109 Juneau, Alaska 99801	Phone 586-7102
Cooperative Extension Service 7th and Madison Ketchikan, Alaska 99901	Phone 225-3290
Cooperative Extension Service 1514 South Cushman, Rm 303 Fairbanks, Alaska 99701	Phone 452-1548 452-1530
Cooperative Extension Service P.O. Box 349 Delta Junction, Alaska 99737	Phone 895-4215
Cooperative Extension Service Pouch K Kodiak, Alaska 99615	Phone 486-5369
Cooperative Extension Service P.O. Box 2610 Sitka, Alaska 99835	Phone 747-8065
Cooperative Extension Service Box 22 McGrath, Alaska 99627	Phone 524-3011
STATE OFFICE **Cooperative Extension Service** **University of Alaska** **WWB-6 Bunnell Building** **303 Tanana Drive** **Fairbanks, Alaska 99701**	Phone 474-7256

UNIVERSITY OF ALASKA AGRICULTURAL AND FORESTRY EXPERIMENT STATION PUBLICATIONS

There are several useful publications available from the University of Alaska Agricultural and Forestry Station. For the purposes of teaching this gardening instructional unit, the "Summary of Vegetable Variety Trials" (published yearly) is very highly recommended.

For a full listing of publications, write:

Publications
Agricultural and Forestry Experiment Station
University of Alaska
309 O'Neill Resources Building
905 Koyukuk Avenue N.
Fairbanks, AK 99775-0080

ALASKAN SEED SOURCES
Alaska Tree and Garden Center
1035 Blair Road
Fairbanks, AK 99701

ALASKAN SEED SOURCES
Denali Seed Co.
P.O. Box 3-3987-ECB
Anchorage, AK 99501

NOTE: It is also possible to get varieties recommended for Alaska through other seed companies, especially those in Canada or the northern United States.

WINTER-BLOOMING ANNUALS

These varieties of annual flowers will bloom indoors, either under a flourescent light or on that proverbial sunny windowsill. There are many more varieties to experiment with.

	SOURCE
Ageratum LITTLE BLUE STAR	B
Ageratum FAIRY PINK	B
Alyssum ROYAL CARPET	A, B, C, D, E, F, G
Dianthus BRAVO	E
Lobelia WEE WILLIE	B, D, E, F
Lobelia CAMBRIDGE BLUE	D
Lobelia CRYSTAL PALACE	A, B, C, D, E, F
Lobelia ROSAMUND	A, E, F
Lobelia WHITE LADY	A, B, C, D, F
Marigold PETITE GOLD	C, F, G
Marigold PETITE ORGANGE	C, F, G
Marigold PETITE YELLOW	A, C, F, G
Nasturtium FERRY FESTIVAL	B
Nasturtium GOLDEN GLOBE	B
Nierembergia PURPLE ROBE	A, B, D, E, F, G
Phlox TWINKLE MIXED	A, C, E, F
Snapdragon MAGIC CARPET MIXED	D
Zinnia PETER PAN MIXED	A, C, D, F, G
Zinnia THUMBELINA MIXED	A, B, C, D, F

SOURCES

A BURPEE SEED CO.
Warminster, PA 18991

B DE GIORGI CO., INC.
P.O. Box 413
Council Bluffs, IA 51502

C JOSEPH HARRIS CO., INC.
Catalog for Commercial Flower Growers
Moreton Farm
Rochester, NY 14624

D HERBST BROTHERS SEEDSMEN, INC.
1000 N. Main Street
Brewster, NY 10509

E E.L. HUDSON SEEDSMEN
P.O. Box 1058
Redwood City, CA 94064

F GEORGE W. PARKS SEED CO., INC.
P.O. Box 31
Greenwood, SC 29647

G R.H. SHUMWAY, SEEDSMEN, INC.
628 Cedar Street
Rockford, IL 61105

Organic Gardening
November 1981

SEED, BULB AND NURSERY SUPPLIERS

The following 251 retail, mail-order sources of everything from asparagus to zoysia grass are spread across the U.S. and Canada, but this listing is by no means comprehensive. The seed trade industry is much too dynamic to be encapsulated so easily. In the same vein, while the eight categories used in this listing help to organize and make the listing more useful, not all suppliers fit our categories exactly, and some categories overlap. In addition to the suppliers listed here, local garden centers and nurseries are often good places to shop for varieties that grow best in your area. Happy Gardening!

1. GENERAL SEED HOUSES (Vegetable and Flower Seeds)

ABUNDANT LIFE SEED FOUNDATION
P.O. Box 772
Port Townsend, WA 98368
(206) 385-5660
(Organic and untreated seeds: vegetables, herbs, wildflowers, trees. All open-pollinated varieties. $3.00 for one-year subscription, $4.00 for Canadian subscribers. Subscription includes seed and *book* catalogs. Sample catalogs, $1.00.)

ALBERTA NURSERIES & SEEDS, LTD.
Box 20
Bowden, Alberta
CANADA T0M 0K0
(Flowers, vegetables, perennials, houseplant seeds, bulbs, trees, hedges, fruits, sundries. Bulbs and nursery stock shipped in CANADA only. Free catalog.)

BURGESS SEED & PLANT CO.
905 Four Seasons Road
Bloomington, IL 61701
(309) 663-9551
(Vegetable seeds, dwarf and standard fruit trees, nut trees, berries, gardening supplies. Free catalog.)

W. ATLEE BURPEE
300 Park Avenue
Warminster, PA 18974
(Flowers, vegetables, fruits, nursery stock, gardening supplies. Catalog free upon request.)

D.V. BURRELL SEED GROWERS COMPANY
P.O. Box 150
Rocky Ford, CO 81067
(303) 254-3318
(Vegetable and flower seeds. Free descriptive catalog.)

COMSTOCK, FERRE & CO.
263 Main St., P.O. Box 125
Wethersfield, CT 06109
(203) 529-3319
(Nationally recognized herb seed list, vegetable and flower seeds; many varieties not easily found elsewhere. Garden supplies. Free catalog.)

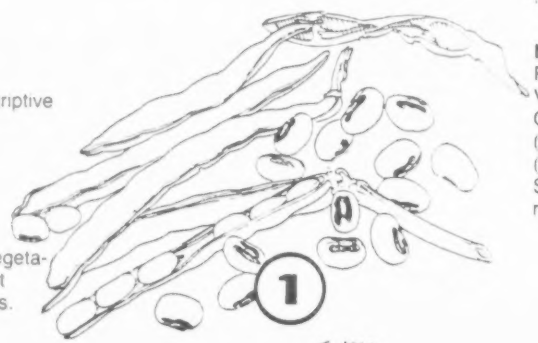
WILLIAM DAM SEEDS LIMITED
P.O. Box 8400
Dundas, Ontario
CANADA L9H 6M1
(416) 628-6641
(Untreated vegetable seeds, field crop seeds, herbs, flowers, houseplant seeds, perennials, tree seeds. Catalog $1.00 to U.S. residents, refundable on first order; free to Canadians.)

DE GIORGI COMPANY, INC.
P.O. Box 413, 1411 Third St.
Council Bluffs, IA 51502
(712) 323-2372
(Vegetable and flower seeds. Catalog $1.00.)

DOMINION SEED HOUSE
Georgetown, Ontario
CANADA L7G 4A2
(416) 877-2801
(Full selection of seed and garden supplies; also rootstock and bulbs. Free catalog. FOR CANADIAN GARDENERS ONLY.)

FARMER SEED & NURSERY
818 N.W. 4th St.
Faribault, MN 55021
(507) 334-2071
(Vegetable and flower seeds, fruit trees and small fruits, shade trees, shrubs, flower bulbs, roses, perennials, gardening aids. 80-page catalog, free.)

HENRY FIELD SEED & NURSERY COMPANY
Dept. 87, 2176 Oak Street
Shenandoah, IA 51602
(712) 246-2110
(Vegetables, fruits, trees and shrubs, gardening supplies. Free catalog.)



GATEWAY SEED COMPANY
P.O. Box 906
Clinton, IA 52732
(319) 243-6853
(High quality flower and vegetable seeds and related products for the home gardener. Gateway's motto: "Gardening is good for you." 48-page color catalog free upon request.)

GAZE SEED CO., LTD.
9 Buchanan St., P.O. Box 640
St. John's, Newfoundland
CANADA A1C 5K8
(709) 722-4590
(General line of vegetable and flower seeds, utensils, garden supplies. Primarily serve residents of Newfoundland and Labrador. Catalog free to those two provinces; $1.00, refundable, to everyone else.)

GURNEY SEED & NURSERY CO.
Dept. 98, 3106 Page St.
Yankton, SD 57079
(605) 665-4451
(Complete offering—flower and vegetable seeds, nursery stock, gardening supplies. Free catalog.)

JOSEPH HARRIS CO., INC.
Moreton Farm
Rochester, NY 14624
(Vegetable and flower seeds, gardening supplies. Free catalog.)

ED HUME SEEDS, INC.
P.O. Box 1450
Kent, WA 98032
(Vegetable and flower seeds, bulbs, gardening booklets, $1.00 or less, include "Houseplant Care," "Vegetable Gardening," "Garden Almanac" and others. Catalog free.)

ISLAND SEED CO., LTD.
P.O. Box 4278, Station A
Victoria, British Columbia
CANADA V8X 3X8
(604) 479-3170
(Carry vegetable, herb and flower seeds. Specializing in tomatoes. Catalog free upon request.)

JACKSON & PERKINS CO.
1 Rose Lane
Medford, OR 97501
(503) 776-2000
(Flower and vegetable seeds, berries, dwarf fruit trees. Free catalog. Also offer a rose catalog.)

J.W. JUNG SEED CO.
Randolph, WI 53956
(414) 326-3121
(Garden, farm and flower seeds, ornamental shrubs and plants, gardening supplies. Free catalog.)

D. LANDRETH SEED CO.
P.O. Box 27174
Leadenhall and Ostend Streets
Baltimore, MD 21230
(301) 727-3922; 3923
("America's oldest seed house," established 1784. Specializing in old-time and new vegetable varieties, hybrid corn, herb seeds, flower seeds and grass seeds. Free price list.)

OROL LEDDEN & SONS
P.O. Box 7
Sewell, NJ 08080-0007
(609) 468-1000
(Vegetable seeds and plants, farm seed, annual and perennial flower seeds, gardening supplies and equipment. Free catalog.)

LETHERMAN'S, INC.
1221 Tuscarawas Street East
Canton, OH 44707
(216) 452-5704
(Vegetable and flower seeds, grass seed, turf products, landscaping tools, gardening supplies. Free colorful catalog.)

LINDENBERG SEEDS, LTD.
803 Princess Avenue
Brandon, Manitoba
CANADA R7A 0P5
(204) 727-0575
(Flower and vegetable seeds, gardening supplies. Free catalog.)

EARL MAY SEED & NURSERY CO.
100 N. Elm Street
Shenandoah, IA 51601
(712) 246-1020
(Complete offering of flower, vegetable and lawn seed, vegetable plants, bulbs, perennials, trees, shrubs, evergreens, roses, and garden aids. Free catalog.)

McFAYDEN SEED CO., LTD.
P.O. Box 1800
Brandon, Manitoba,
CANADA R7A 6N4
(204) 727-0766
(Vegetable and flower seeds, gardening supplies, also kitchen equipment. Catalog $1.00.)

MELLINGER'S, INC.
2310 W. South Range Road
North Lima, OH 44452
(216) 549-9861
(Complete gardening and landscaping catalog of plants and accessories; free, $1.25 first class.)

THE MEYER SEED COMPANY
600 S. Caroline St.
Baltimore, MD 21231
(Flower and vegetable seeds, fertilizers, garden supplies. Free catalog.)

L.L. OLDS SEED CO.
P.O. Box 7790
Madison, WI 53707
(608) 249-9291
(Flower and vegetable seeds, bulbs, Northern-grown fruits, berries, hardy ornamental shrubs, gardening supplies. Free 84-page color catalog.)

GEORGE PARK SEED CO., INC.
Hwy. 254 North
Greenwood, SC 29647
(803) 374-3341
(Flower and vegetable seeds, bulbs, perennial plants and houseplants, herbs, wildflowers, gardening supplies. Free catalog.)

PONY CREEK NURSERY
Tilleda, WI 54978
(715) 787-3889
(Vegetable and flower seeds, trees and shrubs, gardening supplies. Free catalog.)

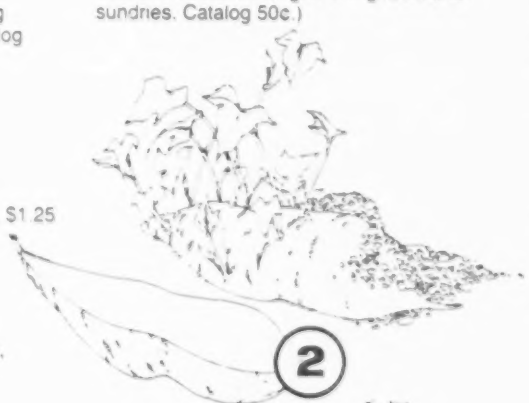
PORTER & SON, SEEDSMEN
P.O. Box 104
1510 E. Washington St.
Stephensville, TX 76401
(Vegetable and flower seeds. Specializing in Texas and Southwestern varieties. 48-page catalog free upon request.)

SEEDWAY, INC.
Box 250
Hall, NY 14463
(716) 526-6391
(Vegetable and flower seeds. Free catalog.)

R.H. SHUMWAY SEEDSMAN, INC.
628 Cedar St., P.O. Box 777
Rockford, IL 61105
(815) 964-7243
(Vegetable and flower seeds, bulbs, nursery items, gardening supplies. Free catalog. "Now in our 114th year.")

STOKES SEEDS, INC.
Box 548, 737 Main St.
Buffalo, NY 14240
and
STOKES SEEDS, LTD.
39 James St., Box 10
St. Catherines, Ontario
CANADA L2R 6R6
(416) 688-4300
(Vegetable and flower seeds, gardening supplies. Free catalog.)

T&T SEEDS, LTD.
P.O. Box 1710
Winnipeg, Manitoba
CANADA R3C 3P6
(Vegetable and flower seeds, grass seed, perennials, bulbs and rose bushes, shrubs, fruit and shade trees, gardening tools and sundries. Catalog 50c.)



THOMPSON & MORGAN, INC.
P.O. Box 100
Farmingdale, NJ 07727
(201) 363-2225
(Vegetable and flower seeds. "World's Largest Seed Catalog" free.)

TREGUNNO SEEDS, LTD.
126 Catherine St. N.
Hamilton, Ontario
CANADA L8R 1J4
(416) 528-5983
(Flower and vegetable seeds, lawn grass, gardening supplies. Free catalog for Canada only.)

OTIS S. TWILLEY SEED CO.
P.O. Box 65
Trevose, PA 19047
(215) 639-8800
(Vegetable and flower seeds, gardening supplies. Free catalog.)

WYATT-QUARLES SEED CO.
Box 2131
Raleigh, NC 27602
(919) 832-0551
(Vegetable and herb seeds, flower seeds and bulbs, grasses and farm seeds, gardening supplies. Free catalog.)

II. VEGETABLE SPECIALTIES (Unusual, Regional, Ethnic)

WALTER BAXTER SEED CO.
P.O. Box 8175
Weslaco, TX 78596
(512) 968-3187
(Will fill orders, both large and small, for most any vegetable grown in Texas and surrounding areas. No catalog.)

BISHOP'S SEEDS, LTD.
Box 338
Belleville, Ontario
CANADA K8N 5A5
(613) 968-5533
(Specialize in small portions of farm seed and grains. Also carry tried-and-true varieties of vegetables with a smattering of the new. Catalog free upon request. CANADIAN ORDERS ONLY.)

BOUNTIFUL GARDENS
5798 Ridgewood Rd.
Willits, CA 95490
(415) 328-6752
(Bountiful Gardens is a nonprofit project of Ecology Action, the organization responsible for John Jeavon's *How to Grow More Vegetables . . .*, among other things. They offer a wide range of untreated, open-pollinated vegetable, herb and flower seeds. They are also the sole U.S. source for Chase Seeds—organically grown varieties of European heirloom vegetables. Catalog $1.00; includes gardening supplies, book list and tools.)

BUTTERBROOKE FARM SEED CO-OP
78 Barry Road
Oxford, CT 06483
(203) 888-2000
(Specializing in chemically untreated, pure line, short-maturity vegetable seeds at reduced prices. Seed list free.)

CROCKETT SEEDS
P.O. Box 237
Metamora, OH 43540
(419) 644-4061
(Specializing in untreated vegetable seeds. Also carry 10 varieties of popcorn. Catalog free until Feb. 1; after that, 25c.)

J.A. DEMONCHAUX CO.
827 N. Kansas Avenue
P.O. Box 8330
Topeka, KS 66608
(913) 235-8502
(French vegetable and herb seeds, gourmet foods. Catalog free; send 50c for handling.)

EXOTICA SEED COMPANY
8033 Sunset Blvd.
Suite 125
Los Angeles, CA 90046
(213) 851-0990
(Rare, hard-to-find fruits, vegetables, nuts, palms and flowering trees from around the world. Catalog $2.00.)

FAR WEST FUNGI
P.O. Box 763
Watsonville, CA 95077
(Complete offering of mushroom spawn and growing supplies—Shiitake, button, almond, tree-oyster mushrooms and more. Also dried mushrooms, growing manuals and easy-to-grow kits. For catalog send a business-sized SASE.)

FRED'S PLANT FARM
Rt. 1, P.O. Box 707
Dresden, TN 38225
(901) 364-5419
(Sweet potato seeds and plants; tobacco seed and products. Send SASE for price list.)

GARDEN CITY SEEDS
Box 297
Victor, MT 59875
(406) 961-4837
(Part of a nonprofit organization dedicated to self-reliance and specializing in older short-season varieties. Emphasis placed on organic growing and open-pollinated varieties. Also, over 100 varieties of northern-acclimated herb plants. Catalog $1.00.)

THE GOOD SEED COMPANY
P.O. Box 702-D4
Tonasket, WA 98855
(Untreated, non-hybrid, public-domain seeds for northern growers, featuring heirloom vegetables, native American maize, tepary beans, herbs, wildflowers, more. Handwritten catalog available for two first-class stamps. Trade/barter welcome.)

GRACE'S GARDENS
10 Bay Street
Westport, CT 06880
(203) 226-5453
(Unusual vegetable and flower seeds, including French, Italian, Chinese and Mexican vegetable varieties. Guinness World Records. Catalog 50c.)

JONATHAN GREEN & SONS, INC.
P.O. Box 326
Farmingdale, NJ 07727
(201) 938-7007
(Sprouting seeds, flower and vegetable seeds, herb seeds, "garden requisites," grass seeds. Information available upon request.)

HALIFAX SEED COMPANY, LTD.
P.O. Box 8026, Station A
Halifax, Nova Scotia
CANADA B3K 5L8
(Specializing in Atlantic-Canadian and short-season varieties. Vegetable seeds, flower seeds, hay seed, miscellaneous garden supplies. Catalog free to Canadian residents, $1.00 to U.S. residents.)

HASTINGS
P.O. Box 4274, Dept. C-63
Atlanta, GA 30302
(404) 524-8861
(Specializing in vegetable seeds and nursery stock for the South; flowers, fruit and nut trees. Free catalog.)

HORTICULTURAL ENTERPRISES
P.O. Box 810082
Dallas, TX 75381-0082
(Over 30 varieties of peppers, both hot and sweet. Also jicama and several herbs used in Mexican cooking. "Happiness is staying healthy . . . eating chiles!", their unique poster catalog proclaims.)

ILLINOIS FOUNDATION SEEDS
Box 722
Champaign, IL 61820
(217) 485-6260
Sweet corn seeds. Price list free upon request.)

LE JARDIN DU GOURMET
P.O. Box 30
West Danville, VT 05873
(Shallots, leeks, garlic, herbs, French vegetable seeds. Catalog plus eight sample packs of herb seeds—$1.00.)

JOHNNY'S SELECTED SEEDS
Albion, ME 04910
Office: (207) 437-9294
Orders: (207) 437-4301
(Hardy early varieties of vegetable seeds for the North; herbs, farm seed, gardening aids. Free catalog.)

KALMIA
P.O. Box 3881
Charlottesville, VA 22903
(Hard-to-find shallots, garlic varieties and multiplier onions, including the potato and white multiplier onions. Books offered on the history and growing of onions and garlic. Catalog free.)

KERNCRAFT
434 W. Main St.
Kutztown, PA 19530
(215) 683-6335
(Specializing in imported vegetable seeds—French, Italian and German. Sold in collections. Price list free.)

KILGORE SEED CO.
1400 W. 1st St.
Sanford, FL 32771
(Vegetable and flower seeds for Gulf Coast states and the sub-tropics. Catalog free.)

KITAZAWA SEED CO.
356 W. Taylor St.
San Jose, CA 95110
(Japanese and Chinese vegetable seeds. Price list.)

LAGOMARSINO SEEDS
5116 Folsom Blvd.
Sacramento, CA 95819
(916) 455-3046
(A pioneer seed company in business since the 1890s. Specializes in older varieties and European vegetables. Also carries flower seed, pasture seed and cover crops with a full line of Rhizobial inoculants. Catalog free upon request.)

LIBERTY SEED CO., INC.
Box 806-B
New Philadelphia, OH 44663
(216) 364-1611
(Specializing in vegetable, flower and herb seeds for the serious gardener. Catalog free.)

LOWDEN'S BETTER PLANTS & SEEDS
P.O. Box 7010
Ancaster, Ontario
CANADA L9G 3L3
(Very early tomato varieties, squash, raspberries and blackberries; organically grown. Sell plants and seeds in Canada; can send only seeds to U.S.A. Descriptive price list, $1.00.)

LE MARCHE SEEDS INTERNATIONAL
P.O. Box 566
Dixon, CA 95620
(Unusual vegetable seeds from around the world. Wide range of old-fashioned, open-pollinated varieties plus new productive hybrids. Descriptive catalog with vegetable histories, drawings and recipes. $2.00.)

MARGRAVE PLANT CO.
117 Church Street
Gleason, TN 38229
(901) 648-5174
(Sweet potato plants. Price list.)

MUSHROOMPEOPLE
P.O. Box 158A
Inverness, CA 94937
(415) 663-8504
(Complete catalog of mushroom literature, kits and supplies; free.)

NICHOLS GARDEN NURSERY
1190 North Pacific Hwy.
Albany, OR 97321
(503) 928-9280
(Gourmet vegetable seeds, seeds for sprouting, herb seeds and plants, dried herbs and spices, herb teas, flower seeds. Unusual varieties. Free catalog.)

OMAHA PLANT FARMS
P.O. Box 787 OG
Omaha, TX 75571
(Onion plants. Free price list.)

PIEDMONT PLANT CO., INC.
Box 424
Albany, GA 31703
(912) 883-7029
(Specializing in tomato, pepper, onion, cabbage and eggplant plants. Free catalog.)

PINETREE GARDEN SEEDS
New Gloucester, ME 04260
(207) 926-3400
(Specializing in small packets of vegetable, herb, flower and houseplant seeds at reduced prices. Space-saving varieties and a large selection of gardening books. Free catalog.)

REDWOOD CITY SEED CO.
P.O. Box 361
Redwood City, CA 94064
(415) 325-7333
(Catalog of useful plants offering vegetables, herbs, fruits, nuts, berries, rare seeds available for 50c.)

SANCTUARY SEEDS
2388 West 4th
Vancouver, British Columbia
CANADA V6K 1P1
(604) 733-4724
(Vegetable seeds, seeds for sprouting, medicinal and culinary herb seeds. Free catalog.)

SHEPHERD'S GARDEN SEEDS
7389 West Zayante Road
Felton, CA 95018
(408) 335-9303
("A unique selection of the finest European vegetable seeds for American home gardeners." Offering individual varieties or special collections of French, Italian, Oriental and Mexican vegetables. Also herb and salad garden collections. Catalog includes growing hints, companion planting tips and recipes; $1.00.)

SOUTHERN EXPOSURE SEED EXCHANGE
P.O. Box 158
North Garden, VA 22959
(Specializing in open-pollinated, disease-resistant vegetable varieties. All seed is untreated and much of it is grown organically. Heirloom seeds, multiplier onions, herbs, sunflowers and uncommon vegetables. A seed exchange service is offered to all. Send three first-class stamps for catalog.)

SOUTHERN GARDEN CO.
P.O. Box 888748
Dunwoody, GA 30338
(404) 394-2771
(Vegetable and herb seeds, gardening supplies. Free catalog.)

SPECIALTY GARDEN SUPPLY
418 Sumner St.
Santa Cruz, CA 95062
(For the West Coast home gardener: selected vegetable, herb and flower seeds reasonably priced in packets sized for the smaller home garden. *Gardener's Notebook* and unique *Grow Box* plans designed for West Coast and short-season conditions. Send self-addressed, stamped envelope for catalog.)

STEELE PLANT CO.
Box 987
Gleason, TN 38229
(901) 648-5476
(Specialize in sweet potato plants. New for '84—mixed dozen—contains three varieties, four plants of each. Free catalog.)

SUNRISE ENTERPRISES
P.O. Box 10058
Elmwood, CT 06110-0058
(203) 666-8071
(Oriental vegetable and flower seeds, Chinese cooking and gardening books in both Chinese and English. Free catalog.)

TATER MATER SEEDS
Rt. 6
St. Joseph, MO 64504
(816) 238-0645
(Breeder of exotic and experimental tomato varieties. Specializing in long-keeping tomatoes of unique shapes, flavors and colors. Also true potato seed and ornamental corn varieties, some with up to 100 colors per ear. Grower's feedback requested to aid breeding research. Catalog free.)

TERRITORIAL SEED CO.
P.O. Box 27
Lorane, OR 97451
(503) 942-9547
(Primarily for gardeners west of the Cascades. Research and sell seeds. Unique American and European selections for short seasons, cool climates. Many overwintered varieties. Free catalog.)

TSANG & MA INTERNATIONAL
P.O. Box 294
Belmont, CA 94002
(415) 595-2270
(Chinese vegetable seeds. Chinese cooking tools and seasonings. Free brochure.)

THE URBAN FARMER
P.O. Box 22198, Dept. OG
Beachwood, OH 44122
(Imported gourmet vegetable seeds from Asia and Europe. Both small and large quantities available. Catalog free upon request.)

VERMONT BEAN SEED CO.
Garden Lane
Bomoseen, VT 05732
(802) 775-7134
(Complete seed line featuring the world's largest selection of beans. Flower seeds, flowering bulb catalog—fall planting. Free catalog.)

VESEY'S SEEDS, LTD.
York, Prince Edward Island
CANADA C0A 1P0
(902) 892-1048
(Vegetable and flower seeds, specializing in short-season varieties. Gardening supplies. Free catalog.)

WILLHITE SEED CO.
P.O. Box 23
Poolville, TX 76076
(817) 599-8656
(Superior quality vegetable seeds. Over 300 varieties. Specialize in watermelon and cantaloupe varieties. Free catalog upon request.)

WILTON'S ORGANIC SEED POTATOES
Box 28
Aspen, CO 81612
(303) 925-3433
("The only Organic HIGH ALTITUDE, certified seed potatoes in the U.S." Write for ordering information.)

III. HERB SEEDS AND PLANTS

ABC HERB NURSERY
Rt. 1, Box 313
Lecoma, MO 65540
(314) 435-6389
(Herb plants, herb collections, houseplant and baby African violet collections. Price list 25c.)

CASA YERBA
Star Rt. 2, Box 21
Days Creek, OR 97429
(503) 825-3534
(Rare herb seeds and plants, all organically grown. Catalog $1.00.)

CATNIP ACRES FARM
67 Christian St.
Oxford, CT 06483
(203) 888-5649
("A most complete source of herb plants—250 + varieties, seeds—175 varieties—and scented geraniums—75 + types. Descriptive catalog lists all these, fragrant oils, potpourri, dried herbs and much more. Catalog $1.00 or price list free.")

COMPANION PLANTS
Rt. 6, Box 88
Athens, OH 45701
(614) 592-4643
(Specialize in organically grown herb plants and seeds—320 varieties. Catalog $1.50.)

COUNTRY HERBS
Box 357
Stockbridge, MA 01262
(413) 298-3884 or 528-0656
(Herb seeds, potpourri ingredients and supplies; miscellaneous items. Free catalog.)

EARTHSTAR GARDENS
Star Route 1, Box 82
Chino Valley, AZ 86323
(602) 636-2565
(Herb plants, products, seeds and dried herbs. Also carry scented geraniums and dried flowers. Catalog free.)

EARTHWORKS HERB GARDEN NURSERY
923 N. Ivy Street
Arlington, VA 22201
(703) 243-2498
(Herb plants, including exclusive introductions. Very informative catalog, $1.00. Ship in April and May only, except for rosemary plants around Christmastime.)

FOX HILL FARM
444 W. Michigan Ave., Box 7
Parma, MI 49269
(517) 531-3179
(Over 300 varieties of herb plants; scented geraniums. Informative catalog $1.00 or send for free price list.)

HARTMAN'S HERB FARM
Old Dana Road
Barre, MA 01005
(617) 355-2015
(Over 300 varieties of herbs and herb products. Live plants, seeds, dried arrangements, wreaths, potpourri, oils. Display garden for visitors. Catalog $1.00; 1984 Herbal Calendar $7.95 + $1.75 shipping & handling.)

HERBS 'N HONEY NURSERY
16085 Airlie Road
P.O. Box 124
Monmouth, OR 97361
(503) 838-5148
(The 16th edition (1980–1985) of their "Botanical Chart-Catalog," listing all of the over 600 varieties of herbs they carry, plus extensive cultural information, is available for $4.95 postpaid.)

HICKORY HOLLOW
Rt. 1, Box 52
Peterstown, WV 24963
(Herb seeds, plants, teas, books, etc. Send SASE for brochure.)

MEADOWBROOK HERBS & THINGS, INC.
Whispering Pines Road
Wyoming, RI 02898
(401) 539-7212
(Herb seeds, natural cosmetics, herb seasonings and teas, books on herbs. Catalog $1.00. Phone open every evening from 5:00–9:00 only.)

THE NATURALISTS
P.O. Box 435
Yorktown Heights, NY 10598
(914) 628-2124
(Native useful plants, wildlife seeds, wildflower seeds, medicinal plants, herbs, etc. Catalog $1.00.)

OTTO RICHTER & SONS, LTD.
Goodwood, Ontario,
CANADA L0C 1A0
(416) 640-6677
(Herb seeds and plants, gourmet vegetable seeds, Alpine seeds, gardening aids, books and dried herbs. Catalog $1.00 + $1.00 postage & handling.)

SANDY MUSH HERB NURSERY
Rt. 2 Surrett Cove Road
R2-OG
Leicester, NC 28748
(704) 683-2014
(Herb plants and seeds, scented geraniums. Catalog handbook $1.00—refundable. Also have books.)

SUNNYBROOK FARMS NURSERY
9448 Mayfield Road, P.O. Box 6
Chesterland, OH 44026
(216) 729-7232
(Herb plants and seeds, scented geraniums, ivies, herbal products. Catalog $1.00.)

TANSY FARMS
RR1
5888 Else Road
Agassiz, British Columbia
CANADA V0M 1A0
(Over 300 varieties of herb plants. Also carry scented geraniums. Ship to U.S. and Canada. Species list free, 40-page, detailed catalog $1.50.)

TAYLOR'S HERB GARDENS, INC.
1535 Lone Oak Road
Vista, CA 92083
(619) 727-3485
(Herb plants and seeds. Catalog $1.00.)

VICTORIA HERB GARDENS
Box 947
Southampton, PA 19866
(215) 355-6084
(Culinary herb plants. Catalog $1.00.)

WELL-SWEEP HERB FARM
317 Mt. Bethel Road
Port Murray, NJ 07865
(201) 852-5930
(Herb plants & seeds, scented geraniums, perennials, dried flowers. Catalog 75c.)

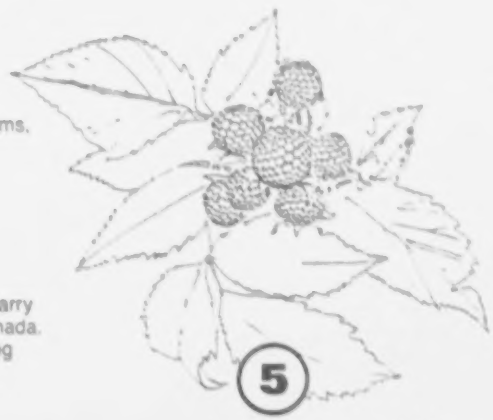
IV. BERRY AND SMALL FRUIT SPECIALTIES

AHRENS STRAWBERRY NURSERY
Route 1
Huntingburg, IN 47542
(812) 683-3055
(Strawberry, raspberry, gooseberry, blueberry and blackberry plants. Currants, grapes and rhubarb. Fruit trees. Garden seed. Free catalog.)

W. F. ALLEN COMPANY
Box 1577
Salisbury, MD 21801-1577
(301) 742-7122
(Specializing in strawberry plants; also blueberries, raspberries, blackberries, grapes, rhubarb, asparagus, horseradish. Featuring a new strawberry called ALLSTAR. Free catalog.)

ALLGROVE FARM
P.O. Box 459-OG
Wilmington, MA 01887
(617) 658-4869
(Hardy raspberry, strawberry and blueberry plants, grape vines, rhubarb plants and asparagus roots. Also hardy native wildflowers, ferns, native trees, shrubs and ground covers. Price list 50c.)

BRITTINGHAM PLANT FARMS
P.O. Box 2538
Salisbury, MD 21801
(301) 749-5153
(Strawberry, blueberry, raspberry and thornless blackberry plants. Grapes, asparagus. Free catalog.)



BUNTING'S NURSERIES, INC.
Drawer 306-OG
Selbyville, DE 19975
(302) 436-8231
(Strawberries, other fruits, nuts, shade trees, shrubs and vines. Free catalog.)

THE CONNOR CO.
Box 534
Augusta, AR 72006
(501) 347-9685
(Arkansas-certified strawberry plants. Do not ship to Calif. or Colo. Free catalog.)

FINCH'S BLUEBERRY NURSERY
Rt. 1, Box 699
Bailey, NC 27807
(919) 235-4664
(Rabbiteye blueberry plants for home gardener and commercial grower. Free brochure and price list.)

DEAN FOSTER NURSERIES
Rt. 2, OG-L
Hartford, MI 49057
(616) 621-2419
(Fruits and berries, flowering trees and shrubs, nut trees; specializing in strawberries. Free catalog.)

HARTMANN'S PLANTATION, INC.
Earleton, FL 32631
(904) 468-2087
(Blueberry plants, extensive listing. Free descriptive catalog.)

ISON'S NURSERY & VINEYARD
Brooks, GA 30205
(404) 599-6970
(Specializing in muscadine grapes, blackberries, blueberries, raspberries, strawberries, fruit and nut trees. Catalog free upon request.)

WM. KROHNE PLANT FARMS
Rt. #6
Dowagiac, MI 49047
(616) 424-3450
(Featuring 14 select varieties of strawberry plants. Plants shipped in bundles of 26. Free brochure.)

MAKIELSKI BERRY FARM & NURSERY
7130 Platt Road
Ypsilanti, MI 48197
(313) 434-3673 or 429-9355
(Small fruits; specializing in raspberries. Also carry currants and gooseberries. Catalog free.)

NORTH STAR NURSERY & BLUE STAR LABS
Route 13
Williamstown, NY 13493
(315) 964-2629
(Specialize in container-grown blueberries and tissue-cultured strawberry plants. Also raspberries, blackberries and asparagus. Catalog free.)

NOURSE FARMS, INC.
Box 485, RFD
South Deerfield, MA 01373
(413) 665-2658
(Strawberry and raspberry plants, asparagus and rhubarb roots. Free catalog.)

RAYNER BROS., INC.
Dept. A60
Salisbury, MD 21801
(301) 742-1598
(Specializing in strawberry, blueberry and asparagus plants; also raspberries, bush fruits, fruit and nut trees, evergreen seedlings. Free catalog.)

SHANTI GARDENS
1 Blueberry Lane
Pettigrew, AR 72752
(501) 677-2300
(Highbush blueberry plants for gardeners and commercial growers. Custom propagation and mail orders. Price list and growing instructions free upon request.)

MAUDIE WALKER
P.O. Box 256
Omega, GA 31775
(Rabbiteye blueberries, muscadine grapes; strawberry, blackberry and raspberry plants. Apple, fig, pear, peach, persimmon, pomegranate and nut trees. Catalog available.)

V. FRUIT AND NUT TREE NURSERIES

THE ADAMS COUNTY NURSERY, INC.
P.O. Box 108
Aspers, PA 17304
(717) 677-8105
(Fruit trees. Free catalog.)

BEAR CREEK FARMS
P.O. Box 411
Northport, WA 99157
(Hardy fruits, nuts, shrubs and grafted trees for the home gardener and commercial farmer, and environmental plantings. Informative price list.)

BOUNTIFUL RIDGE NURSERIES, INC.
Box 250
Princess Anne, MD 21853
(301) 651-0400, Maryland residents
(800) 638-9356, all states but MD, AK, and HI
(Dwarf and standard fruit trees, grapes, berries, nut trees, ornamentals. Free catalog.)

BURNT RIDGE NURSERY
432 Burnt Ridge Road
Onalaska, WA 98570
(Specialize in grafted nut trees from select northern cultivars. Price list available for one self-addressed, stamped envelope.)

CALIFORNIA NURSERY CO.
Box 2278, Niels District
Fremont, CA 94536
(415) 797-3311
(Dwarf and standard fruit trees, nut trees, grapes, citrus fruits. Free brochure.)

CUMBERLAND VALLEY NURSERIES
Box 430
McMinnville, TN 37110
(615) 668-4153
(Peaches, plums, nectarines, pecans. Free price list.)

THE FIG TREE NURSERY
P.O. Box 124
Gulf Hammock, FL 32639
(12 varieties of figs, strawberries, muscadine grapes, poppy seed, pepper seed, mulberry trees. Catalog available for one 20c stamp. Do not ship to California or Arizona.)

FRIENDS OF THE TREES SEED SERVICE
P.O. Box 1064
Tonasket, WA 98855
(Specialize in seeds of trees, shrubs, lesser known fruits—hardy kiwi, for example. Also native American food plants, wildflowers, medicinal herbs. Catalog $1.00; Subscription to Friends of the Trees mailing list $3.00 which includes all newsletters, catalogs, announcements, etc.)

FOWLER NURSERIES, INC.
525 Fowler Road
Newcastle, CA 95658
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(Fruit and nut trees, berries, grapes. Catalog $2.00.)

LOUIS GERARDI NURSERY
RR 1, Box 143
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Route 5, Box 29J
Ellijay, GA 30540
(404) 273-3187
(Dwarf, semi-dwarf and standard fruit trees—apple, peach, pear; specialize in antique peaches; also carry grapes, blueberries. Free catalog.)

LAWSON'S NURSERY
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Ball Ground, GA 30107
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(Dwarf and semi-dwarf fruit trees, espaliered fruit trees, hybrid grapes, berry plants. Free descriptive price list.)

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5060 W. Lake Road
Canandaigua, NY 14424
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Tifton, GA 31793
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(Roses, perennials, trees, shrubs, fruits, vegetable and flower seed. Free catalog.)

KELLY BROTHERS NURSERIES, INC.
100 Maple Street
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Plains, MT 59859
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(Seeds of woody plants, fruit trees, shade and ornamental seedlings, conifers. Request price list.)

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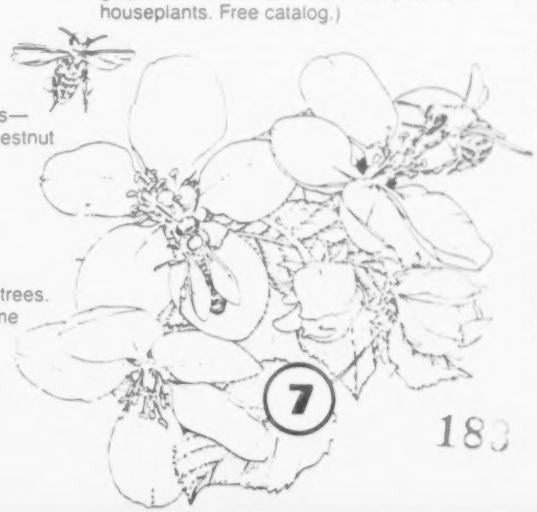
(Evergreens, shade trees, roses, shrubs, ornamentals, dwarf and standard fruit trees, nut trees, small fruits. Free catalog.)



RICHARD OWEN NURSERY, INC.
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PONZER NURSERY
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(314) 341-2593
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F.W. SCHUMACHER CO., INC.
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Catalog Reservation Center
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Geneva, NY 14456
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Montvale, NJ 07645
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(Holland bulbs. Free color catalog and price list.)

EDELWEISS GARDENS
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Robbinsville, NJ 08691
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Toronto, Ontario,
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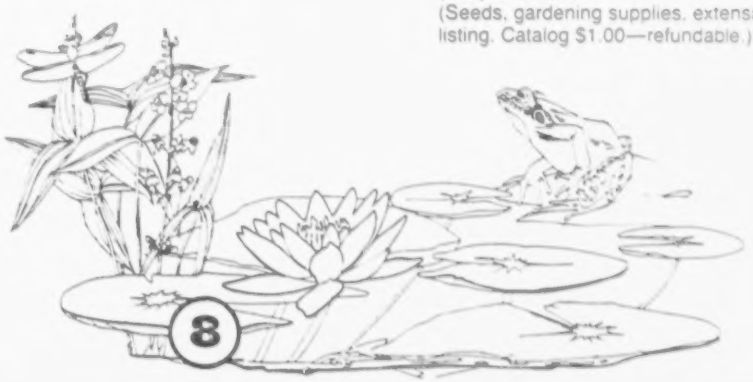
(416) 488-8292
(Seeds, gardening supplies, extensive bulb listing. Catalog $1.00—refundable.)



THE GARDEN SPOT
4032 Rosewood Drive
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(803) 787-7463
(Rare and choice ivy plants. Send SASE for descriptive price list.)

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(Specializing in rhododendrons and azaleas; trees and shrubs, bonsai, succulents. World-wide mail order. Catalog $2.00.)

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A WORLD SEED SERVICE
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EXCHANGE, INC.
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LILYPONS WATER GARDENS
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Lilypons, MD 21717-0010
(301) 874-5133
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2699 Lilypons Road
Brookshire, TX 77423-0188
(Water lilies, pool and aquarium fish, scavengers, pools and accessories, water gardening supplies. Catalog $3.00.)

ANN MANN'S ORCHIDS
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Canby, OR 97013
(503) 266-7711
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THON'S GARDEN MUMS
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(Tropical seeds; agriculture inspected for export; Hawaiian handcrafted gifts. Catalog $1.00.)

VANBOURGONDIEN BROS.
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Babylon, NY 11702
(Holland and domestically grown flower bulbs and plants, fruit and nut trees, berries, perennials, ornamentals. Free catalog.)

VAN NESS WATER GARDENS
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Upland, CA 91786
(714) 982-2425
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WAYSIDE GARDENS
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(803) 374-3359—South Carolina, call collect
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Sarcoxie, MO 64862
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WILSON PLANT SALES
507 S. Indiana St.
Roachdale, IN 46172
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YOUNG'S MESA NURSERY
2755 Fowler Lane
Arroyo Grande, CA 93420
(805) 489-0548
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Reedsville, PA 17084
(717) 667-6998
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Beersheba Springs, TN 37305
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(Specializing in wildflowers from east of the Mississippi. Free catalog.)

CARROL GARDENS
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CONLEY'S GARDEN CENTER
Boothbay Harbor, ME 04538
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ESP WILDFLOWERS
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El Monte, CA 91734-1125
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P.O. Box 10
Pineola, NC 28662
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(704) 656-2334
(Native wildflower plants of North Carolina. Free pamphlet.)

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P.O. Box V-OG
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(414) 685-2929
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(505) 983-1548
(Native plants, wildflower and grass seeds. Vegetables too, including "ancient and adapted Southwestern crops." Catalog $1.00.)

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PUTNEY NURSERY, INC.
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ORGANIC GARDENING Reader Service
Rodale Press, Inc., Emmaus, Pa.
David Riggle, Kent Martin, Jan Wheeler, Betty Frederick
January 1984

EXTENSION AND RESEARCH
PUBLICATIONS

vegetables and fruits for alaska

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF ALASKA, USDA & SEA GRANT COOPERATING

recommended variety list for INTERIOR Alaska

A-00030
Revised February 1986

186

Vegetables and Fruits for Alaska

Recommended Variety List for Interior Alaska

Gardening is a very popular activity throughout the United States and the ranks of home gardeners include people from all walks of life. In addition to providing fresh produce for the family, gardening also provides an escape from the tensions of society and enables the gardener to experience our basic association with the earth.

Alaskan gardening can be a challenge due to cool soil temperatures and short seasons but it can also be very rewarding. Long hours of daylight and the use of varieties adapted to Alaska's climatic conditions can result in a garden that you will be proud of. Gardeners in Alaska have fewer types of garden pests with which to cope than in lower latitudes.

This publication contains information on a very important part of a successful garden—varieties adapted to Alaska. The information is presented in a manner that will enable you to choose one or more varieties of a certain vegetable that should be successful in your garden and will meet your particular requirements. All of these varieties have been field tested by research horticulturists at the Agricultural Experiment Stations in Alaska. Varieties recommended for interior Alaska have been tested at the station in Fairbanks by Dr. Donald H. Dinkel, Grant Matheke, and Pat Wagner.

Most of the varieties have been selected after years of successful testing in research plots at the Agricultural Experiment Station. There are a few, however, which have been included because they have shown exceptional promise after only one or two years of testing.

After you have selected the varieties that are suitable for your location you can obtain the information you need for gardening in Alaska by contacting your District Cooperative Extension Service office and requesting a copy of A-00134, *"16 Easy Steps to Gardening in Alaska."*

The data included in the recommended variety tables contain a wealth of information based on extensive research and observation. It is presented in a manner that will enable you to choose a suitable variety based on comparative data.

The information on maturity and yield are best used in comparing the different varieties. Results may differ for each gardener depending upon soil type and fertility, weather, location, and garden management practices. The important factor to consider is how well each variety does when grown under similar conditions.

Wayne G. Vandre
Horticulture Specialist
Cooperative Extension Service
Anchorage, Alaska

352/2/84/WV

The University of Alaska's Cooperative Extension Service programs are available to all, without regard to race, color, age, sex, creed, national origin or handicap and in accordance with all applicable state and federal laws.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, James W. Matthews, Director, Cooperative Extension Service, University of Alaska.

Recommended Variety List

Garden Vegetables

Varieties in bold type are especially recommended for freezing.

	Variety	Maturity	Yield	Comments
Snap Beans				
Green snap	**Provider**	Earliest	High	Good quality, good freezer
	Spartan Arrow	Early	Good	Good quality, good freezer
	Bountiful	Early	High	Good quality, flat
	Contender	Second Early	High	Good quality, good freezer
Yellow-wax	Honey Gold	Early	Good	Reliable, early
	Beurre de Rocquencort	Early	High	Germinates well in cold soil
Beet	Little Egypt	Early	Fair	Round, resists bolting, small
	Formanova	Intermediate	Good	Resists bolting, long uniform growth, high quality
	Cylindra	Intermediate	Good	Resists bolting, tendersweet, long, high quality
	Burpee Golden	Intermediate	Fair	Yellow, round, high quality
	Sangria	Intermediate	Good	Does not bolt, high quality
Broccoli	**Green Dwarf**	Early	Good	Can be planted closer
	Green Duke	Intermediate	High	Large laterals, excellent quality
	Emperor	Intermediate	High	Good commercial quality
	Green Valiant	Intermediate	High	Good quality
	Shogun	Late	Highest	Large heads to 14" in diameter
Brussels Sprouts	Prince Marvel	Earliest	Highest	Excellent Quality
	Jade Cross E	Early	High	Very good, dependable
	Earli-Jade	Early	High	Good quality
Cabbage	Earliana Hybrid	Early	Fair	Small heads, good quality
	Tastie	Second early	Good	Excellent quality, dependable, short core
	Baby Red Early	Midseason	Good	Red
	Savoy Ace	Midseason	Good	Best savoy type
	Ruby Ball	Midseason	Fair	Red, small head
	Hinova	Late	Very high	Large, good storage type
	Alaskan 6467	Late	High	Good storage type, grow from transplants
Cauliflower	**Snow Crown**	Early	Good	Dependable, good quality
	Early Snowball	Early	Good	Good quality
	Andes	Midseason	High	Good quality
	Delira	Midseason	High	Attractive heads with nice wrapper leaves
	Dominant	Midseason to late	High	Very dependable, good curd
	White Rock	Midseason to late	Very high	Excellent
	White Fox	Late	Very high	Excellent
	White Top	Late	Very High	Excellent, highest yield in trials

	Variety	Maturity	Yield	Comments
Carrots	**Scarlet Nantes**	Early	High	Stores well, good quality
	Early Cross	Early	High	Flavor excellent, stores well
	Spartan Bonus	Midseason	High	Good quality
	Royal Cross	Midseason	High	Flavor excellent
	Royal Chantenay	Late	High	Storage type
Celery	Green Giant	Early	Highest	Good quality
	Utah 52-70	Midseason	High	Dependable
	Transgreen	Midseason	High	Large stalks
Chives — Nearly all kinds do well				
Cucumber* — *grow through clear polyethylene*				
	Early Pride	Early	High	White spine (slicer)
	Slicemaster	Midseason	High	White Spine (slicer)
	Sweet Success	Early	High	White Spine, (slicer)
	Euro-American	Early	High	Smooth Skin, mild flavor (slicer)
	Morden Early	Early	High	Black Spine, very small fruit (pickler)
	Liberty	Early	High	Black Spine (pickler)
Eggplant* — *grow through clear polyethylene*				
	Dusky		Poor	Best eggplant outdoors, but marginal
Greens	Bok Toy Mustard	Early	Good	Very nice when planted late
	Pak Choy	Midseason	Good	Very nice, holds well
	Tendergreen	Midseason	Good	Good mustard
	Rhubarb Chard	Midseason	Good	Very attractive, smaller than white types, tends to bolt
	Rex	Midseason	High	Good quality
	White King Chard	Midseason	Good	Slow to bolt, good size, white ribs
	Vates Collards	Late	Good	Good quality
Kale—Nearly all kinds do well				
Kohlrabi	Grand Duke	Earliest	High	Very nice, early
	Prima	Early	High	Large, good quality
Leeks	Giant Elefant	Late	Good	Large diameter, variable
	King Richard	Late	High	Nice long neck
	Leader	Late	High	Good Quality, long neck
Lettuce				
Head	Great Lakes 659	Midseason	Fair	Fair quality, susceptible to tipburn
	Ithaca	Midseason	Good	Good quality and flavor, reliable
	Minilake	Earliest	Good	Good quality and flavor, short core
	Montello	Midseason	Good	Good quality

	Variety	Maturity	Yield	Comments
Lettuce (cont)				
Butterhead	Ostinata	Early	High	Bolt resistant, dependable
	Kagran Sommer	Early	Good	Bolt resistant, dependable, good quality
Cos Romaine	Paris Island Cos	Midseason	High	High quality, dependable
	Valmaine	Midseason	High	High quality
Looseleaf	Salad Bowl	Early	High	Excellent, bolt resistant
	Red Salad Bowl	Early	Good	Good quality, bolt resistant
	Oak Leaf	Early	Good	Very nice quality and appearance
	Grand Rapids	Midseason	Good	Fair quality
	Prizehead	Midseason	good	Red tip, good holding quality
	Ruby	Midseason	Good	Nice red
Onion				
Bunching	He-shi-ko	Midseason	Fair	Good quality
	Evergreen White	Midseason	Fair	Good quality
Sets — Any kind should do well				
Parsley—Nearly all kinds do well				
Parsnip	Hollow Crown, Improved	Late	Good	Good quality, most dependable
Peas	**Sparkle**	Early	Good	Dependable
	Oregon Sugarpod (Little Sweetie)	Early	Good	Edible podded
	Sugar Ann	Early	Good	Edible podded, like snap bean, doesn't require support
	Dwarf Grey Sugar	Early	Good	Edible podded, dependable
	Lincoln	Early	High	Good quality
	Novella	Midseason	High	Semi-leafless
	Sugar Snap	Midseason	Good	Edible podded, like snap bean
	Sugar Rae	Midseason	Good	Edible podded, like snap bean, doesn't require support
	Green Arrow	Late	Highest	Outstanding quality, long pods
	Freezonian	Late	High	Indeterminate type, good quality
Peppers* — *grow through clear polyethylene*				
	Early Prolific	Early	High	Elongate to blocky, turns red early
	Park's Early Thickset	Midseason	High	Good quality
	Gypsy	Early	Good	Pointed, yellow
	Hungarian Yellow Wax	Midseason	Good	Hot yellow
	Karlo	Midseason	Good	Hot yellow
	Italian Sweet	Early to midseason	High	Italian sweet type
Potato	Rote Erstling	Early	Good	Red, tough skin, yellow flesh, good quality
	Alaska Red	Early	High	Red, tender skin
	Kennebec	Early	High	Tender skin
	Green Mountain	Late	High	Good quality
	Swedish	Late	Low	Home garden type

	Variety	Maturity	Yield	Comments
Potato (cont)	Bakeking	Midseason	High	Good quality, baking
	AK 114	Late	High	Good quality, even size, tough skin
	Norgold Russet	Late	High	Good quality, attractive
Pumpkin* — *grow through clear polyethylene (use transplants 4-5 weeks old)*				
	Little Boo	Midseason	Fair	Medium size, ghost white pumpkin
	New England Pie (Small Sugar)	Midseason	Good	Small, good baking quality
	Connecticut Field	Midseason to Late	High	Good size
Radish	Cherry Belle	Early	Good	Good but doesn't hold
	Inca	Early	Good	Good quality
	Burpee White	Midseason	High	Holds longest without bolting
	Giant White Globe	Midseason	High	Like Burpee White
	Tokinashi	Late	High	Large white, daikon type
	White Icicle	Late	Fair	Long
Rhubarb	**McDonald**	Early	High	High quality
	Canada Red	Early	High	High quality
Rutabaga	York	Midseason	High	Club root resistant
	American Purple Top	Midseason	High	Good storage type
	Altasweet	Midseason	High	Milder flavor
Spinach	**Melody**	Early	High	Plant early, excellent quality, most bolt resistant
Squash* — *grow through clear polyethylene*				
Summer	**Aristocrat**	Early	High	Excellent quality
	Black Eagle	Early	High	Excellent quality
	Zucchini Elite	Early	High	Excellent quality
	President	Early	High	Excellent quality
	Greyzini	Early	High	Striped, nice flavor
	Goldrush	Early	High	Striking yellow zucchini
	Sundance	Midseason	High	Yellow crookneck, excellent but has very long neck
	Seneca Prolific	Midseason	Fair	Yellow, Botrytis resistant
Winter	Gold Nugget	Earliest	Good	Good quality, dependable, bush type, small size
	Sweet Mamma	Early	High	Good quality
	Buttercup	Midseason	High	Dark green, excellent quality
	Improved Hubbard	Late	High	Very large, ave. 20 lbs in trials
	Pink Banana	Late	High	Large, elongate
	Golden Hubbard	Late	High	Excellent quality
	Hungarian Mammoth	Late	High	Largest fruit, ave. 35 lbs in trials

	Variety	Maturity	Yield	Comments
Sweet Corn* — *grow through clear polyethylene*				
	Yukon Chief[1]	Early	Fair	Dependable for cool soils, open pollinated
	Polar Vee	Early	Fair	Dependable for cool soils
	Earlivee	Midseason	High	Best quality, nice ears
[1]Developed at the Agriculture Experiment Station, University of Alaska				
Tomato (Outdoors)* — *grow through clear polyethylene*				
	Sub-arctic 25	Earliest	Good	Small fruits
	Santa	Very Early	Good	Small fruits
	Gem State	Very Early	Good	Small fruits
	Shoshone	Very Early	Good	Small fruits
	Sub-arctic Plenty	Early	Fair	Small fruits
	Early Tanana[1]	Early	Good	Ripens well when picked green
	Bonner	Early	Fair	Larger fruit
[1]Developed at the Agriculture Experiment Station, University of Alaska				
Tomato (Hanging Basket)				
	Basket King	Early	Good	Small fruits
	Pixie	Early	High	Small fruits
	Toy Boy	Early	Good	Small fruits
Turnip	Tokyo Cross	Early	Good	Use for small turnips, high quality
	Purple Top White Globe	Late	Good	Good for storage
	Petrowski	Late	Good	Some resistance to root maggots, yellow flesh

Greenhouse Vegetables

	Variety	Maturity	Yield	Comments
Cucumber— *all are long European type and are gynoecious (all female flowers)*				
	LaReine	Early	Highest	Dependable, good quality
	Femdan	Early	High	Good quality
	Toska 70	Early	High	Even size, good quality
	Superator	Early	High	Large size
Tomato	Tuckcross 520	Early	High	Resistance to leaf mold
	Tuckcross 533	Early	High	Resistance to leaf mold
	Vendor	Early	High	Good quality
	Sugar Lump	Midseason	Fair	Cherry type, many fruits, excellent quality

Fruit Varieties

Survivability of some of the varieties may only be realized in the more favorable sites. Careful selection of a growing site as well as observation of successful gardeners and trials with several varieties will increase success with fruit growing. Your local nursery is a good source of the recommended varieties.

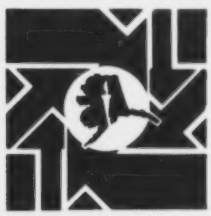
	Variety	Maturity	Yield	Comments
Strawberry	Alaska Pioneer[1]	Early	High	Hardy, yield is high when well fertilized and watered
	Toklat[1]	Midseason	High	Hardy, larger fruit than Alaska Pioneer
	Quinault	Midseason to frost	Highest	Grow as an annual through polyethylene
[1]Developed at the Agriculture Experiment Station, University of Alaska				
Raspberry	Latham	Late	Good	Good quality
	Boyne	Late	Good	Good quality
	Kiska[1]	Early	Good	Most hardy
[1]Developed at the Agriculture Experiment Station, University of Alaska				
Currant	Red Lake	Late	Good	Hardy in higher elevations
	Holland Longbunch	Late	Excellent	Hardy in higher elevations
Gooseberry	Pixwell	Late	Good	Hardiest, for higher elevations
Apple-Crabapple	Rescue	Late	Fair	Marginally hardy
	Heyer No. 12	Late	Fair	Marginally hardy
	Columbia	Late	Fair	Marginally hardy
Crabapple	Adam			Marginally hardy
	Sylvia			Marginally hardy
	Jacques			Marginally hardy

***Crops for Production Through Polyfilm**

Warm season crops will benefit by planting through a clear plastic mulch. The clear plastic hastens soil warmup by allowing the sun's rays to penetrate the soil and prevents heat from being dissipated by the wind. Caution is required, however, since most seedlings sunburn if not released from beneath the plastic as soon as they emerge from the soil. Sweet corn may remain under the plastic until 4 to 6 inches tall before being released. Transplants may be planted under plastic by cutting an X or by making a hole through the plastic with a bulb planter.

Storing Vegetables in Root Cellars and Basements in Alaska

Reprinted August 1984



COOPERATIVE EXTENSION SERVICE

by
Ray Morgan
Community Development Agent

UNIVERSITY OF ALASKA, USDA AND SEA GRANT COOPERATING

A-00331

ORM/356/4/82

Vegetable storage in Alaska has some special requirements; insulation, humidity, ventilation, and temperature. Insulation needs to be considered as a means of keeping severe cold out in the case of a root cellar or to keep out the heat in a basement storage area. High humidity is another requirement for most vegetables. Adequate humidity will usually occur in a root cellar where you have a dirt floor, but in the basement where walls and floor are usually vapor proof, maintaining sufficient humidity may be a problem. Ventilation at the right time and in the right amount will help in controlling both temperature and humidity. Few, if any, home owners in Alaska have automatic equipment to take care of both temperature and humidity, therefore these must be regulated by hand. Temperature can easily be controlled by a thermostat when electricity or a furnace is available. Coastal areas of Alaska are often more humid than other parts of the state and this requires a different management technique for controlling humidity. A fan may be needed in the vent pipe to assist in expelling the humid air.

Not all vegetables have the same temperature and humidity requirements. Squash, pumpkins, tomatoes and similar vegetables have a lower requirement, about 60% relative humidity with a desired temperature of about 60° F. Potatoes, cabbage, turnips prefer a 90% relative humidity. The higher humidity promotes less shrinkage in vegetables but makes a more suitable atmosphere for growth of bacteria and fungus. Add a high temperature to the high humidity and the fungus growth is more pronounced. This means, for best results, you should have two storage areas; a drier warmer area to store members of the cucurbit family, and a cooler moist area to store root vegetables such as potatoes and turnips.

Basement storage will often need moisture added, if it has a concrete floor. Placing a pan of water on the floor will help. At other times, water may have to be sprinkled on the floor by hand. A sling psychrometer is an inexpensive instrument that can be used to determine both temperature and humidity.

Some vegetables have peculiar storage characteristics. For example, apples and potatoes should not be stored near each other, since one will pick up the flavor from the other. Turnips and cabbage stored in the basement can produce odors which will penetrate up into the living quarters of the house and also taint the flavor of other vegetables stored with them. Celery stored near turnips and cabbage may also absorb their odors. Do not wash beets, leave roots on and about 1/2 inch of stem.

Stored vegetables are not dead but are living organisms that will continue to use stored food and breathe (respire) in storage. If they respire rapidly, the stored food in the vegetable will be used, quality will diminish, and the vegetable will slowly break down. Exposure to light will also encourage some vegetables to grow. A slotted wooden floor and wall will help with ventilation and reduce the likelihood of freezing.

Carrots and beets store very well at 32-40° F. in 5 or 10 gallon containers. Storing in such containers will prevent excessive shriveling. Cover containers with a cloth to keep air moist. If carrots are stored at a higher temperature, cut the stem off, and store in damp (not wet) sand or sphagnum moss. Beets can also be stored this way, leave at least one half inch of top on beets.

Cucumbers, rutabagas, turnips, and parsnips may be waxed and stored at 32° to 40° F. If not waxed or if stored at a higher temperature, place in containers of moist sand.

Cabbage can be stored off the floor or hung from the ceiling at 32° to 40° F. Leave at room temperature for several days to allow outer leaves to dry. You may also wrap cabbage in newspaper and store in boxes.

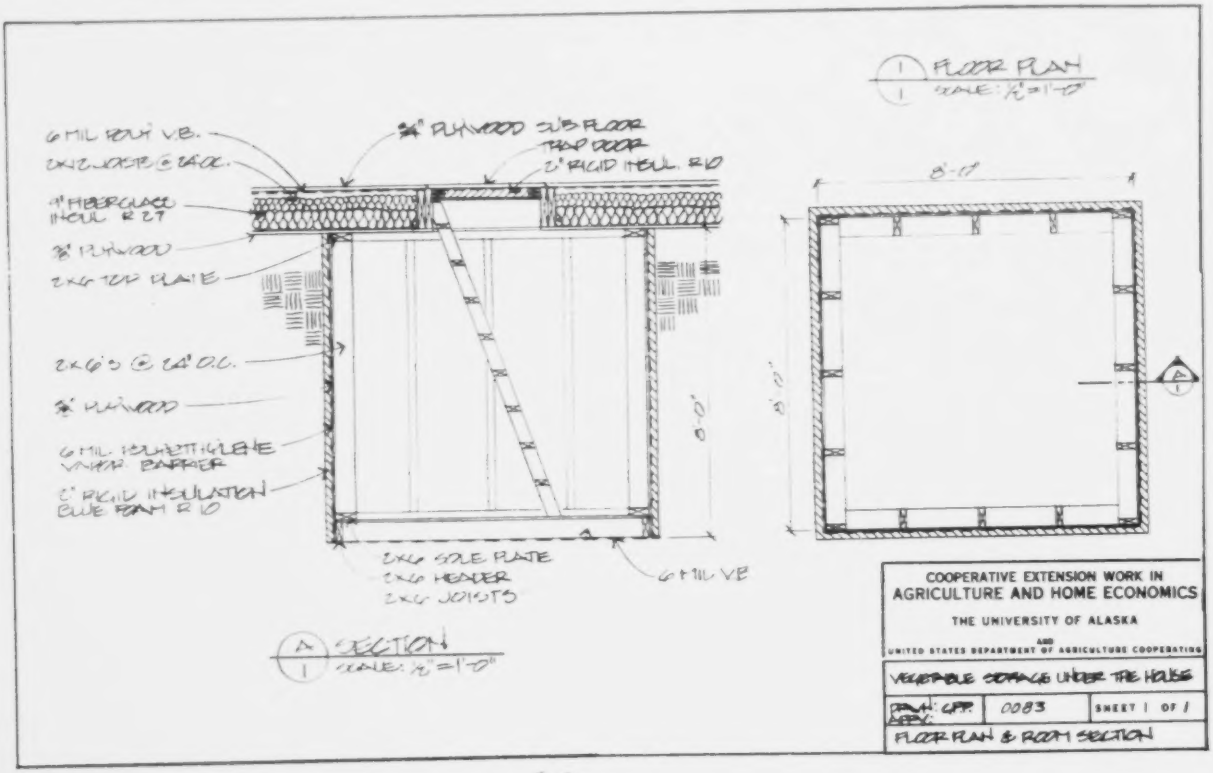
Celery can be stored for a few months by lifting it out of the garden with roots attached, replant in a box of sand or soil in the cellar at 32° - 36° F. Keep the soil damp but avoid getting water on the plants.

Potatoes should be kept at room temerature for about two weeks to allow cuts to heal and the skin to toughen. Then store in bins away from light to prevent greening (a combination of chlorophyll and solanine). Store at 36°-42° F. to prevent sweetness. If they do become sweet, hold at room temperature for a few days before using. If the temperature is above 40° F., potatoes will begin to sprout after two or three months. You can treat potatoes with a sprout inhibitor when sprouts begin to break through the eyes, usually in late December or early January.

Tomatoes can have their season extended by pulling up the vine with mature green tomatoes, hang upside down in the garage or basement. Another method would be to pick all tomatoes from the vine, wash gently, remove stems, dry, and pack not over two layers deep, wrapped individually in newspaper or newsprint. Keep green tomatoes at 50° to 60°; pink fruit ripens best at 40° to 50° F. Sort weekly to separate ripening tomatoes.

Parsley and chives may be dug out of the garden in the fall, potted and grown as house plants. Keep as much root as possible when moving. These plants will provide leaves for flavoring dishes during the winter months.

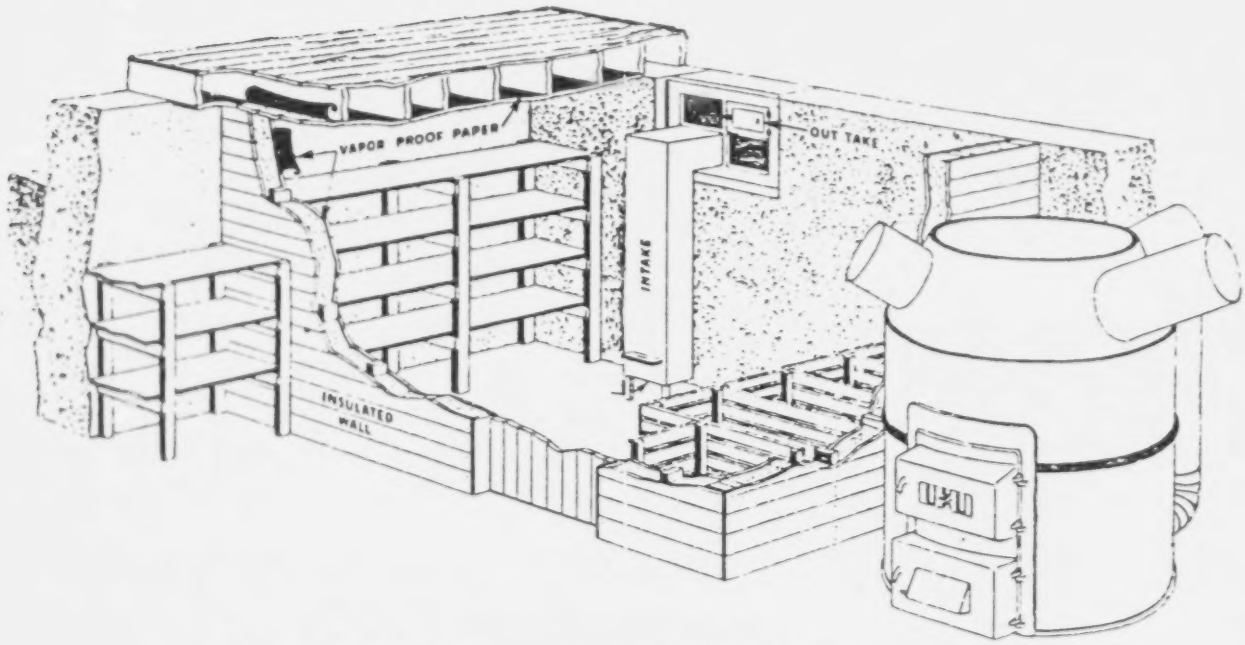
Other types of food preservation methods to consider are drying, freezing, canning, and pickling. These methods may be preferable for those vegetables and small fruits that have a short shelf life.



BASEMENT OR ROOT CELLAR STORAGE

If you are fortunate enough to have a basement as part of your home, then building a storage area could easily be done. A corner of a heated garage may also be converted to a storage area. The outer wall should have a window to help with ventilation.

Without a basement or garage, you will need to dig a hole in the ground near your home and cover up the root cellar after it has been constructed. Keep in mind you will need access to some type of supplemental heating before spring arrives if storage is not connected to your house. You may also dig a root cellar under the kitchen or living room, if you have no basement. Cut a trap door in the floor to store or retrieve vegetables. This method is often used in rural Alaska.



A well-insulated room in the basement can provide good, cool, moist storage for vegetables.

Storage time and temperatures for some vegetables grown in Alaska.

VEGETABLES	TEMP F°	% HUMIDITY	LENGTH OF STORAGE TIME	COMMENTS
Beans (Green)	45°	85-90	9 Days	
Beets	32°	90-95	3 Months	
Broccoli	32°	90-95	14 Days	
Brussel Sprouts	32°	90-95	4 Weeks	
Cabbage	38°	90-95	4 Months	Early varieties only 6 weeks
Carrots	32°	90-95	5 Months	Topped
Cauliflower	32°	85-90	3 Weeks	Remove all leaves
Celery	32°	90-95	4 Months	Transplanted
Cucumbers	50°	85-90	3 Weeks+	Waxed
Turnips	38°	90-95	3 Months	Waxed
Kohlrabi	38°	90-95	3 Months	
Onions	32°	55-60	8 Months	
Potatoes	38°	85-90	8 Months	
Squash	60°	55-60	3 Months	Winter varieties
Tomatoes	60°	55-60	8 Weeks	Store on vine
Small Fruits	32°	85-90	7 Days	

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Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, James W. Matthews, Director, Cooperative Extension Service, University of Alaska.

ALASKA GARDENING TIPS

A-00335

Reprinted June 1987

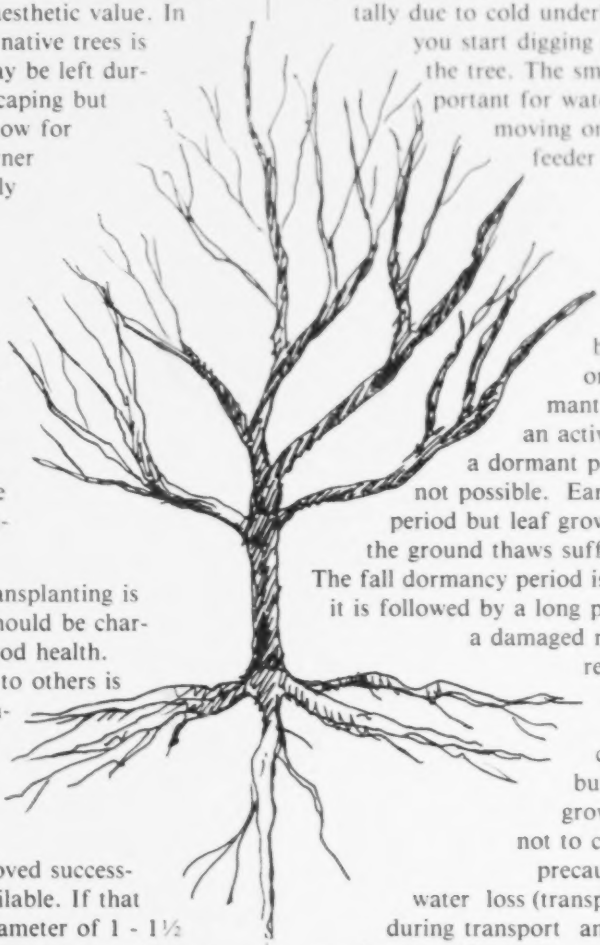
TRANSPLANTING TREES SUCCESSFULLY

A landscaped property is a definite asset to the owner in terms of monetary as well as aesthetic value. In many areas of Alaska the use of native trees is quite common. Some of these may be left during initial construction and landscaping but too often they are removed to allow for these activities. The property owner must then replace them with hardy exotics or with the same species of native trees.

Whether you are undertaking the initial landscaping of your property, adding to the number of trees already there, or moving a tree from one location to another, it is important to do it correctly. Even the hardiness of a native tree cannot overcome the effects of poor transplanting techniques.

Choosing a suitable tree for transplanting is the first step in this process. It should be characteristic of the species and in good health. A tree that is growing very close to others is often narrow and tall due to competition for light and space. Look for signs of physical damage and symptoms of insect or disease problems.

Choose a tree that can be removed successfully with the tools you have available. If that is a spade, a tree with a trunk diameter of 1 - 1½ inches is probably the largest you can move without extensive root damage. The root systems of most native trees are relatively shallow rooted and spread out horizontally due to cold underlying soil conditions. When you start digging stay beyond the dripline of the tree. The small roots at the end are important for water and nutrient uptake. Removing or damaging those important feeder roots puts additional stress on the tree after transplanting.



A tree that is in a dormant state is less likely to suffer transplant shock because the demands placed on the root system by a dormant tree are much less than by an actively growing one. Winter is a dormant period but digging is usually not possible. Early spring is also a dormant period but leaf growth often starts by the time the ground thaws sufficiently to remove the tree. The fall dormancy period is usually preferable because it is followed by a long period of time during which a damaged root system can regrow and recover. This will occur even though the tree appears dormant and the soil is cold. If you have no choice but to move a tree during the growing season be very careful not to cause root damage and take precautions to prevent excessive water loss (transpiration) from the leaves during transport and after planting. Selective pruning as well as the use of windbreaks and antidesicants are techniques to consider.

COOPERATIVE EXTENSION SERVICE
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Carefully remove the root ball by digging under the roots and toward the center from all sides. It can then be carefully rolled onto a tarp, burlap or heavy plastic and tied securely to hold the root ball in place and prevent root drying.

Transporting the tree to the new location should be done in such a way that drying effects are kept to a minimum. Hauling trees in the bed of a pickup for long distances can cause severe water loss from the foliage followed by leaf drop after transplanting.

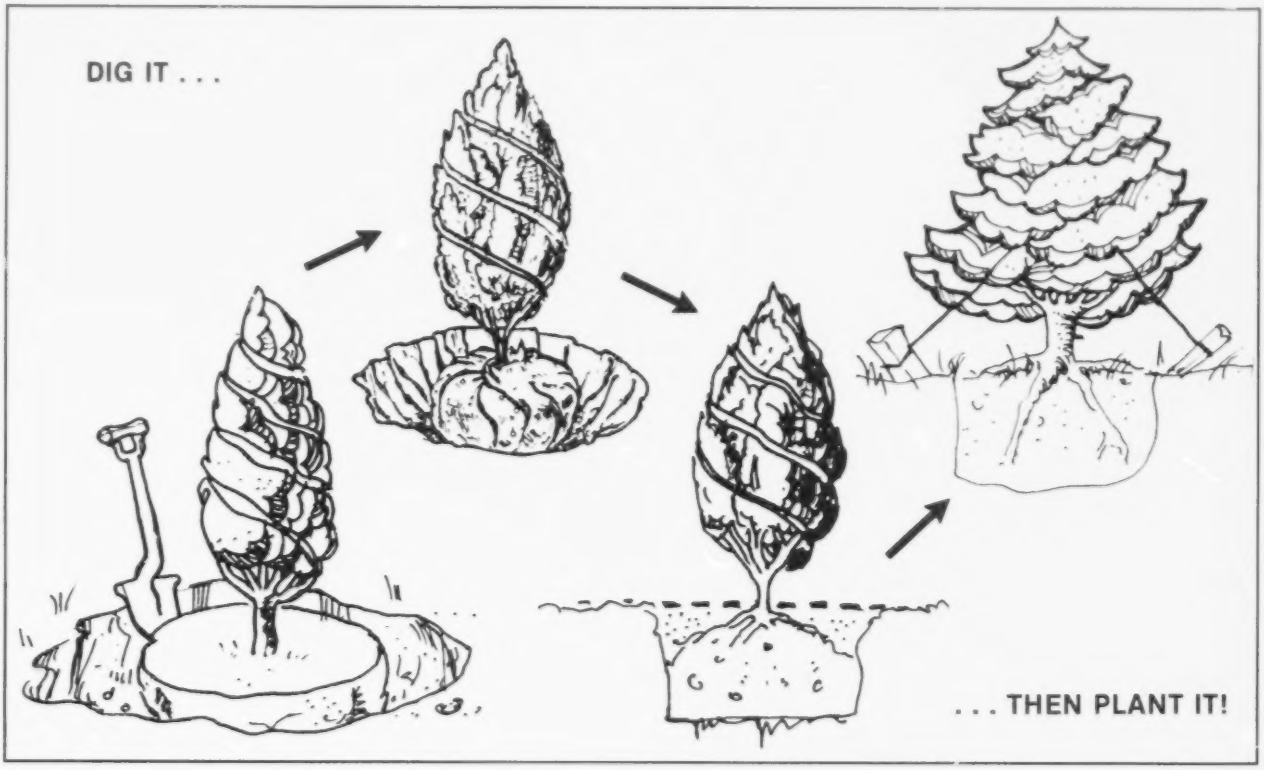
The new planting site should be chosen and prepared in advance. Consider the tree's requirements for sun, soil, water and air drainage, wind protection and winter protection. Survival of transplanted trees is greatly increased if you can satisfy the environmental needs of each plant.

The hole for replanting should be at least twice the diameter and depth of the root ball. This is especially important if the new site has a tight or poorly drained soil.

Backfill the planting hole so that the tree will be positioned at the same depth as it was growing. Place the tree in the hole, remove the wrapping from the root ball and carefully reposition the roots on top of the soil. Water should be added to the soil several times during the filling procedure to settle the soil and eliminate any air pockets. Continue placing soil in the hole until only a slight depression remains. This will allow for easier watering of the tree.

You should support the tree using stakes and guy wires. This will help to prevent root tearing if the tree is subjected to strong winds. Damaged bark or girdling may result if the guy wires are too tight or not attached properly. Short sections of plastic water hose can be used to prevent damage where the wire contacts the tree.

Keep the tree well watered during the transplant recovery period. If you were careful in your tree selection and followed correct transplanting procedures, your tree will continue its healthy growth in its new home.



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374/6/85/WV-JR

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The Compost Heap in Alaska

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF ALASKA, USDA & SEA GRANT COOPERATING

Alaska's cool soil and air temperatures are not very conducive to the composting of organic materials. Decomposition of organic matter takes place by bacterial and fungal action under moist, warm conditions. These requirements are only partially met in Alaska, thus the breakdown needed for good compost development occurs slowly. However, the benefits of a good compost heap will be realized by those willing to do a little extra work and willing to wait the necessary time for decomposition. In most areas the decomposition will take a minimum of one to two years and often three, depending largely on how favorable a site has been chosen for the heap and what practices are employed to hasten the decomposition of organic materials.

THE VALUE OF COMPOST

Good compost consists of a small amount of soil along with decomposed plant and animal residues. As a soil amendment, compost improves both the physical condition and fertility.

It is especially useful for soils with low organic matter. The physical benefits to soil include: improved aeration, improved root penetration, improved water infiltration, and reduced crusting of the soil surface. Increased water holding capability in sandy soils is also a benefit.

Although compost contains nutrients, its greatest benefit is in improving the soil's physical characteristics. Therefore, it should not be considered a complete fertilizer. In most cases, additional fertilization will be necessary to achieve maximum plant growth and production.

BUILDING THE PILE

SITE: The choice of site may easily make a year's difference in the time the organic material decays. A protected well drained area receiving maximum heat from the sun should be selected. Building the pile within a tight wooden or cement box or utilizing a pit (methods often used in warmer climates) should be avoided in Alaska. The boxed method retains so much liquid that the bottom of the pile may become a solid block of ice and may not completely thaw during Alaskan summers. The pit method is impractical since our cold soils actually inhibit decomposition.

STARTING THE HEAP

The first thing to remember is that indiscriminate piling of trash does not make good compost. Start a neat pile with layers of uniform thickness. A width of four feet should be a maximum in cold climates. The length is not important and the usual height (depth) is about three feet.

Coarse materials are used in the first layer and should be approximately six inches deep for a good foundation. Tall weeds or old flower stalks can be used. Lay in the foundation layer with some order over the full width of the intended pile. This will aid in a uniform breakdown and ease the repiling later. Diseased or pest laden plants should not be used. Pests may survive in incompletely composted material.

A-1-022

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The second layer should be three inches deep and composed of a finer material. Manure is recommended, but leaves or grass clippings are quite satisfactory. **Kelp** may also be used. Dried kelp will require additional moisture to insure decomposition.

At this point start to build the sides and ends of the pile slightly higher than the center, continuing this practice throughout the construction. This will gradually form a dish-shaped top surface which tends to hold the added water.

The third layer should be a sprinkling of commercial fertilizer. One pound (pint) to 10 square feet is about right. 10-20-10, 8-32-16, or any other formula readily available is quite satisfactory.
The fourth layer should be an inch of good garden loam. The fifth layer is coarse material again and the layer arrangement is repeated until it has reached the desired height.

It is more satisfactory to completely build up a short pile (five or six feet long) than to make a long low pile and continue adding material over a long period of time. A short pile that is completely built over a short period of time will develop a uniform compost ready for use.

WETTING: If properly built, the top of the heap will be dish-shaped. Wet the pile throughly. Some people drench the pile with **warm** water when it is first built. This may increase initial bacterial action but is not a necessary practice except in very cool regions.

COVERING: To hasten the breakdown of organic matter and maintain optimum moisture levels in the heap, the use of clear (milky) plastic **polyvinylchloride** has proven most satisfactory. The clear plastic cover allows the sun's rays to pass through and warm the heap while helping to retain the absorbed heat as well as the heat of decomposition. Moisture levels remain more constant since the clear plastic cover prevents evaporation and sheds rainfall.

To cover the heap, take a single large sheet of clear plastic and cover the pile completely. The plastic must touch the ground all around. Cover the lower edge of the plastic with dirt to completely seal the edge. Let the covered pile stand undisturbed for 10 weeks.

TURNING: To help make a uniform compost, the pile should be forked over after 10 or 12 weeks. Mark an area about the same size as the original. In repiling the material, place the edge and end material in the center of the new heap. Repile with squared-up sides and dished top as before. It is common practice to sprinkle a little additional fertilizer through the heap as it is repiled.

In Alaska this repiling may be so late that all or part of the following summer will be required to complete composting. If a new heap is started each summer, you will have a plentiful supply of compost on hand after the second year.

USE: When the new material is to be used, remove the compost from bottom to top rather than forking off the top. For potting soil or seed flat use, screen the compost through a coarse ¼" screen, returning the larger material to the pile. Rubbing the compost vigorously will make most of the material pass through the screen.

PASTEURIZATION TREATMENT: Incompletely composted materials may be treated with a soil disinfectant. Follow the directions on the label carefully. Heating soil at 140 degrees F. for one hour will also destroy many harmful organisms. It should be remembered that completely composted organic matter needs no further treatment before use. If the above suggestions are followed, your compost heap will turn out as well as those in warmer climates.

WHAT MATERIALS MAY BE COMPOSTED?

A compost pile can effectively decompose many materials but is should not be regarded as a general-purpose garbage pile. Organic materials such as sod, grass clippings, leaves, weeds, manures (livestock), sawdust, shredded newspapers, wood ashes, hedge clippings, and garden plant refuse all can be used for composting. Unleached wood ashes contain about 5-7% potash, 1.5-2% phosphoric acid, and 25-30% calcium. It can be added to the compost pile in relatively large amounts due to its low nutrient levels, but it will raise the pH of the soil that it is applied to, so consider this if you are going to use compost for acid-loving plants. Layers of ashes should be not more than three inches thick to facilitate overall decomposition of the pile. The calcium in wood ashes facilitates decomposition.

Diseased plants should be avoided since the disease organisms may be returned to the garden. Weed seeds usually do not completely decompose so it may not be desirable to include seed-laden weeds.

Garbage can be added to the compost pile but you should avoid grease, fat, meat scraps, and bones. These can attract dogs and other animals and may develop an ordor during decomposition. In addition, the fats are slow to break down. If attracting animals and producing odors are not problems, then fish wastes can also be added to the list. Avoid large items such as branches because they decompose very slowly.

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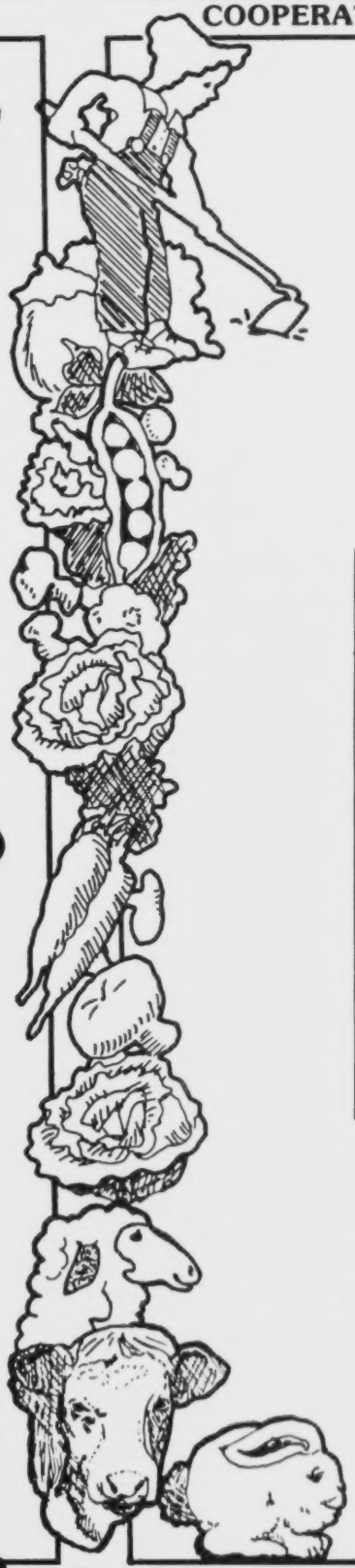

ANIMAL MANURE AS FERTILIZER

A value that is often overlooked by persons producing animals on a small scale is the potential of the manure produced for fertilizers. For example, Table #1 shows that a 1,000 pound cow will produce 15 tons of manure per year. This 15 tons contains approximately 171 pounds of Nitrogen (N), 46 pounds of Phosphorus (P_2O_5), and 148 pounds of Potassium (K_2O). When one considers that 80 pounds of 8-32-16 has 6.4 pounds of N, 25.6 pounds of P, and 12.8 pounds of K, the potential is significant.

Table #1

Plant Nutrients in One Ton of Different Manures*

Figures given in pounds/ton. Includes solid, liquid & bedding.

Animal	N	P_2O_5	K_2O	Tons of Manure Produced/Year Per 1,000# Wt.**	Water Content
Cow (1)	11.4	3.1	9.9	15.0	84%
Steer (1)	15.0	6.0	8.0	8.5	80%
Sheep (6 or 7)	15.8	6.7	18.0	7.5	65%
Swine (3 sows)	9.9	6.7	9.3	18.0	75%
Horse (1 light)	13.2	5.1	12.1	10.0	60%
Chickens (flock)	21.0	16.4	10.2	4.5	75%

* Cornell Extension Publication 642, Dr. R. Bradfield, Cornell Department of Agronomy.

**Based on animals confined to stalls year-around.

In addition to the 3 major elements of N, P, and K, manure also contains several essential micro-nutrients. The average pounds/ton of these nutrients are shown in Table #2, on the following page.

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Table #2 - Micro-nutrients in Animal Manure (pounds/ton)

Kind of Animal	Boron	Calcium	Copper	Iron	Magnesium	Manganese	Molyb.	Sulfur	Zinc
Horses	.03	15.7	.01	.27	2.8	.02	.002	1.4	.03
Cattle	.03	5.6	.01	.08	2.2	.02	.002	1.0	.03
Sheep	.02	11.7	.01	.32	3.7	.02	.002	1.8	.05
Hogs	.08	11.4	.01	.56	1.6	.04	.002	2.7	.12
Laying Hens	.12	74.0	.03	.93	5.8	.18	.011	6.2	.18
Broilers (litter)	.08	29.0	.06	2.00	8.4	.46	.007	---	.25

USDA Research Data - Ohio

Farm animal manure also supplies valuable organic matter. Organic matter improves soil tilth, increases water holding capacity, lessens erosion, improves soil aeration, and has a beneficial effect on soil microorganisms and plants.

The value of livestock manure is based on:

1. Class of animal
2. Kind of feed consumed
3. Kind of bedding used
4. Method of handling
5. Rate and method of application
6. Kind of soil and crops on which it is used.

Research has shown that manure will lose approximately 1/3 of its fertilizer and organic matter value in three months; 1/2 in 6 months, and even more over a longer period. When manure is exposed to the weather, ammonia gas washes away with the rain, phosphorous is washed or drained away with the liquid portion; potassium is either washed away or carried off in the urine; and organic matter is rotted away.

To reduce manure losses the following steps are recommended.

1. Use ample bedding to absorb liquid manure.
2. Store manure in straight-sided well packed piles.
3. Store manure in an area that has a water tight bottom and provide overhead protection from weather.
4. Keep livestock on pasture as much as possible in summer months.
5. Add phosphate to manure pile to trap nitrogen at a rate of 20# of 0-46-0/ton.
6. Use plenty of bedding and let manure accumulate in stables until it can be hauled and spread directly in the fields.

Other points to consider in handling manure include:

1. Avoid spreading manure on frozen ground.
2. Avoid spreading manure when the wind is blowing toward your neighbor's house.
3. Avoid spreading manure within 100' of streams, lakes or ponds.
4. Incorporate manure by disking and plowing when practical.
5. Do not exceed 12 tons/acre when applying manure.
6. Manure that comes from animals which consume hay may contain weeds and grass seeds that can germinate and contaminate your fields. Chickweed and quack grass are two examples.
7. The technology that exists today does not make the production of methane from manure economically feasible for people who farm on a small scale.

Prepared by Jerry Purser, Agriculture Development Agent, Cooperative Extension Service, Mat-Su District, P.O. Box 869, Palmer, Alaska 99645.

STARTING DATES FOR VEGETABLE & FLOWER SEEDS TO GROW TRANSPLANTS

The rule of thumb for determining starting dates for seeds is to count back the required number of weeks from the last spring frost date. Here in the Fairbanks area, predicting the last spring frost becomes a challenge. Over a long term average, the last spring frost occurs on approximately May 13th, but in some areas, there is no month of the year free of record lows below 32° F.

In general, the first of June seems to be a dependable date to use. By June first, the snow has melted and the soil is dry enough to work up for a garden area. Protection may be needed for tender plants such as tomatoes, squash, and cucumbers on cold nights after June 1st, but in general, we can plan on no further frosts.

Using June 1st as a garden planting date, the following dates provide a guide for starting seeds for growing transplants, assuming good light and optimum growing conditions.

DATE	VEGETABLES	FLOWERS
February 24 (14 weeks)		Portulaca Geranium
March 9 (12 weeks)		Hollyhock Digitalis (Foxglove)
March 16 (11 weeks)	Celery Leeks	Lobelia Gazania Carnation Shasta Daisy
March 23 (10 weeks)	Greenhouse tomatoes* (5-6 weeks)	Pansy Salvia
March 30 (9 weeks)	Brussels Sprouts Peppers* Eggplant*	Dusty Miller Nemesia Godetia Bells of Ireland Petunia Cosmos
April 6 (8 weeks)	Tomatoes*	Dahlia (from seed) Dianthus Aster Ageratum Snapdragon Candytuft Chrysanthemum (annual)

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April 13 (7 weeks)	Parsley Herbs	Alyssum Oriental Poppy Helichrysum Statice Bachelor Buttons Sunflower Dimorphotheca (African Daisy) Calendula Verbena Nicotiana Godetia Layia Matricaria Phlox
April 20 (6 weeks)		Zinnia Salpiglossis
April 27 (5 weeks)	Cabbage* Cauliflower * Broccoli* Melons**	Marigolds Nasturtiums Schizanthus
May 3 (4 weeks)	Cucumbers** Pumpkin** Winter Squash** Head Lettuce	
May 10 (3 weeks)	Summer Squash**	

Vegetables which can be seeded in the garden prior to June 1st but not before May 15th with little danger of loss due to frost are:

Beets	Lettuce	Potatoes
Carrots	Mustard	Radishes
Corn	Parsnips	Spinach
Chard	Peas	Turnips
Dill		

There are many flowers not listed above which you may wish to try in your garden. For these flowers, use the directions on the seed packet as a guide.

* Each seedling should be transplanted into a pot after the first true leaves develop.

** Since roots should be disturbed as little as possible, plant 3 or 4 seeds in a 3-4" pot. Before or after transplanting into the garden, thin to two plants.

PW-3/ 85

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Cooperative Extension Service
University of Alaska
and U.S.D.A. Cooperating

Tanana District
Cooperative Extension Service
1514 S. Cushman Room 303
Fairbanks, Alaska 99701

General Fertilizer - Peat - Lime Recommendations

Garden - With plenty of water available, 3 lbs. fertilizer per 100 sq. ft. of soil.
With little or no water available, 2 lbs. of fertilizer per 100 sq. ft.

Recommended general garden fertilizer is 10-20-20, 10-20-10, or 8-32-16.

Flowers - Keep the soil pH on the low side, soil should be high in organic matter, fertilize with high phosphorus fertilizer such as 8-32-16 at the same rates as above. Use 10-52-10 in irrigation water according to package directions.

Greenhouse Vegetables - Use water soluble fertilizer on a weekly basis, such as 10-52-10 or 10-52-17.

Cucumbers - after the 6th cucumber has set, apply 1/2 lb. of ammonium nitrate per 100 sq. ft. every 10 days.

Peat - 10-12 lbs lime per cubic yard of peat added to garden soil

1/2 lb. lime per cubic foot of peat added to garden soil

No lime on area intended for potatoes.

Soil Mix for Containers: 1 part peat
2 parts garden soil
1 part sharp sand or perlite
lime according to directions above.

For best results, have your soil tested by the Cooperative Extension Service,

1514 S. Cushman Room 303, Fairbanks, Alaska 99701. 452-1530. Cost = $5.00

5/86

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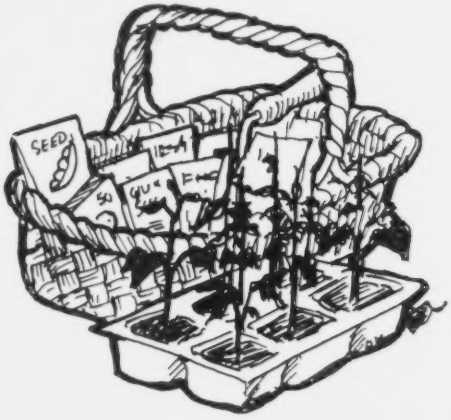
SEED STARTING and TRANSPLANTING



COOPERATIVE EXTENSION SERVICE

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210

The growing of transplants enables the gardener to mature many warm-season vegetables, to hasten maturity of cool-season vegetables, and to achieve a longer season of display for many annual flowers. Based on usual home temperatures (68°–72° F.) with at least ten hours of daylight, the average number of weeks needed to grow transplants to the proper sizes are indicated below. Subtract the number of weeks listed from the average date of the last spring frost in your locality to determine planting dates. Less favorable growing conditions may require the longer period of time.

Vegetables	Weeks	Remarks
Broccoli	4–6	
Cabbage	4–6	
Cauliflower	4–6	
Celery	10–12	Slow growing.
Cucumbers	3	Start two seeds in individual containers and remove the weaker one after they germinate.
Lettuce (Head)	4–6	Start inside for early harvest.
Peppers	6–7	
Winter Squash	3–4	Start three seeds in individual containers and remove the weaker one after they germinate. Plant directly from pots.
Tomatoes	7–9	Transplant when near bloom. Do not subject to frost.

12/81/352/WV

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FLOWERS

Flowers marked with an asterisk(*) in the following list do well in cooler temperatures of 50°–55° F. The novice will do well to try flowers from this group.

Six to Eight Weeks

Butterfly-Flower	*Schizanthus*
English Daisy	*Bellis perennis*
Feverfew	*Chrysanthemum parthenium*
Lobelia	*Lobelia sp.*
Nemesia	*Nemesia sp.*
Flowering Tobacco	*Nicotiana sp.*
*Petunia	*Petunia hybrida*
*Snapdragon	*Antirrhinum majus*
*Sweet Alyssum	*Lobularia maritima*
Verbena	*Verbena laciniata*

Four to Six Weeks

*African Daisy (Cape Marigold)	*Dimorphotheca sp.*
*Ageratur (Floss Flower)	*Ageratum sp.*
Aster	*Aster sp.*
Godetia	*Godetia sp.*
*Larkspur	*Delphinium brownii*
*Nasturtium	*Tropaeolum majus*
Stocks	*Matthiola sp.*
Bachelor Button	*Centaurea cyaneus*
*Candytuff	*Iberis sempervirens*
*Clarkia	*Clarkia pulchella*
Dahlia	*Dahlia pinnata*
*Marigold	*Tagetes erecta*
*Phlox	*Phlox sp.*
Zinnia	*Zinnia elegans*

Four Weeks in Individual Containers

Canary Bird Vine	*Tropaeolum peregrinum*
Mignonette	*Reseda odorata*
*Nemophila	*Nemophila sp.*
Sunflower	*Helianthus annus*

MATERIAL NEEDED FOR STARTING TRANSPLANTS

Container

Almost any type of container can be used as long as it can be properly drained and will stand up for three months when damp. Some possible choices include wood flats, plant pots, peat pots, peat pellets, tin cans, milk cartons, foil pie plates, plastic freezer cartons, etc.

Germinating Media

Although soil and potting mixtures may be used, they are **NOT** necessary to insure germination. Vermiculite, sphagnum moss, sand, perlite or other **STERILE** material which can be kept uniformly moist is satisfactory. If a soil mixture is used, moisten it and bake it in the oven to sterilize it (½ hour at 180° is sufficient), or use 1/4 cup of 40 percent formaldehyde in one gallon of water to drench the soil. Sterilized media is required to prevent 'damping off' disease from killing the seedlings. Fill the containers to within about 1/2 inch of the top. The seedling surface should be firm but not hard in order to give good contact between soil and seed. Remember that all containers, tools, and the working area must be clean and sterile also to prevent reinfection. Wood and plastic can be sterilized with a mixture of one part chlorine bleach to nine parts water. Clean containers first and let stand in bleach solution for 30 minutes. Allow to dry before re-use.

Seed Treatments

Many seeds from commercial sources are already treated with compounds to prevent 'damping off.' If they are not or if they are home-grown seeds, they should be treated. Contact your local district Extension office for recommendations on seed treating.

SEEDING AND GROWING TRANSPLANTS

Seeding

Space or scatter seeds well apart. Nearly everyone plants many more seeds than can grow for even a short time. Plant in rows if more than one type of seed is used.

Covering Seeds

Cover very lightly. Fine seeds need no cover at all if kept moist. If covered, the surface should be firmed to insure good seed-soil contact. Cover should be to a depth of two times the seed diameter.

Watering

Water seeds gently but thoroughly. Fog or mist would be ideal to keep the surface moist. The container can also be put in a pan of water to absorb moisture from the base. This also helps to avoid damping off by keeping the surface dry.

Covering the Container

Glass or plastic may be used to keep seeds moist. An old newspaper may be used until the seeds germinate.

Heat

Place in a suitable area where the temperature is about 70° F. Heat at the bottom of the container hastens seed germination. Avoid placing covered containers in direct sunlight. A few plants such as larkspur, snapdragon, sweet pea, cabbage, broccoli, and cauliflower start best at about 55° F.

After Germination

New seedlings need light and fresh air. Remove newspapers, glass or plastic covers after seedlings appear. If not all seeds germinate at the same time, keep ungerminated rows covered until seedlings appear. Strips of newspaper work well for this.

'Damping Off'

This is the major trouble to watch for with new seedlings. Poor circulation of air and/or crowded plants are ideal conditions for 'damping off.' Increase air circulation and thin the plants at the first sign of trouble. Plants should have circulation of air at the soil surface. A fungicide may be required if the disease is extensive. Excessive heat and humidity and insufficient light also create conditions suitable for damping off.

Transplanting

Transplant seedlings to individual containers or flats filled with sterilized garden soil as soon as the first true leaves appear. In flats, space the seedlings on centers at least two inches by two inches. Larger growing plants should be placed in individual containers. Handle the plants gently by the upper leaves. Use a pointed stick (dibble) to roll out or 'prick off' the seedlings. **DO NOT PULL THE PLANTS.** Avoid tearing the roots and replant at the same depth as the plant was growing in the seed flat.

SETTING PLANTS OUT IN THE GARDEN OR YARD

'Hardening Off' Plants

Before transplanting outdoors the plants should be 'hardened off.' This is achieved by withholding water and carrying them outside for progressively longer periods of time each day. As plants start to 'harden off,' they may become slightly yellow with tinges of red at the edges of the leaves. Allow a week or more for this process. A cold frame works well for this procedure. Avoid wind or temperature below 45° F. This transition period is important in harsh climates.

Starter Solution

Use starter solution when transplanting to get the plants off to a good start in their new environment. Follow mixing directions on the container carefully. Use ½ to 1 cup of solution per plant. A good solution is one tablespoon of high phosphorus fertilizer in 1 gallon of water.

ROOT Maggots IN ALASKAN HOME GARDENS

by

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A-00330

Revised June 1984

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6/84/173/WGV

ROOT MAGGOTS IN ALASKAN HOME GARDENS

By David P. Bleicher

Root maggots are the most serious annually recurring insect pest problem of vegetable production in Alaska. They attack all varieties of crucifers. Although home gardeners are familiar with the damage caused by these insects, they generally don't concern themselves with preventive measures. Successful vegetable growers make themselves aware of potential pest problems and plan a pest management strategy before planting their gardens.

When root maggot larvae feed on tubers of root crops such as turnip, rutabaga, and radish, they leave surface scars and feeding tunnels (Figure 1). Any feeding scars may render the produce unacceptable for market, but the home gardener might trim off lightly damaged portions if the extent of damage is not too great. However, the root often is severely damaged. Feeding tunnels predispose the plants to infection by soft-rot bacteria and to secondary infestation by springtails and thrips.

Feeding by root maggot larvae on the stem crucifers (cauliflower, broccoli, cabbage, Brussels sprouts, and kohlrabi) results in slight to severe decline of the plants. The extent of decline depends on the variety of the host (Figure 2). Young plants may be girdled and die. Root systems on older plants may be extensively damaged and the tap root may be destroyed. In wet seasons, the damaged plants may be able to survive with a constant supply of water at the soil surface and cool air temperatures because of the production of adventitious roots. If plants survive, yield and quality are reduced. On warm days the reduced root system cannot support the plant and the plant wilts. If days are warm and surface moisture is low, damaged plants may die.

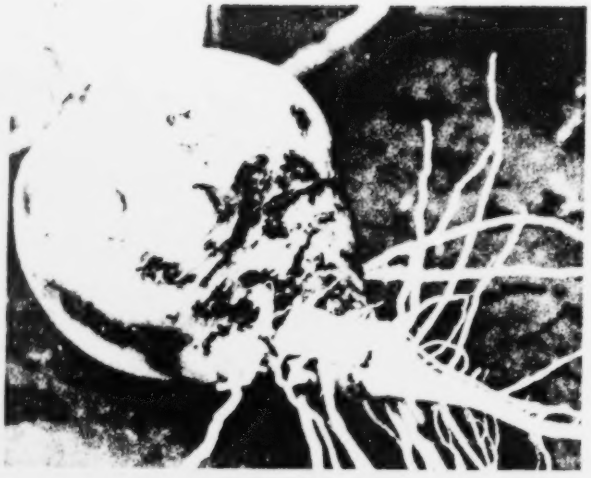


Figure 1. Damage to turnip caused by root maggot larvae. Note the scars of surface feeding and entrances to feeding tunnels within the root.

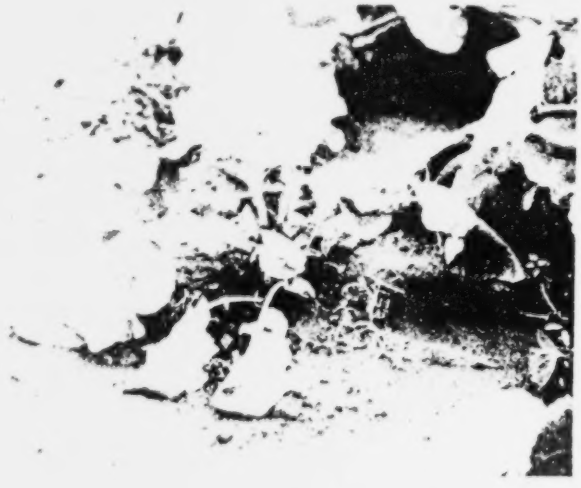


Figure 2. Broccoli plant showing symptoms of root maggot damage.

To effectively deal with root maggots, it is necessary to have an understanding of their biology and seasonal activity. Root maggots are the immature stages, or larvae, of flies that resemble the common housefly. The two species that are important as pest of crucifers in Alaska are the turnip maggot *Hylemya floralis* and the seed corn maggot *Hylemya platura*. The turnip maggot is found throughout Alaska and feeds on all varieties of crucifers. The seed corn maggot is a more general feeder; it is sometimes found infesting seed potato, but is most important as a pest of crucifer plantings. The impact of the seed corn maggot appears to be greater in the Southern, coastal areas of Alaska.

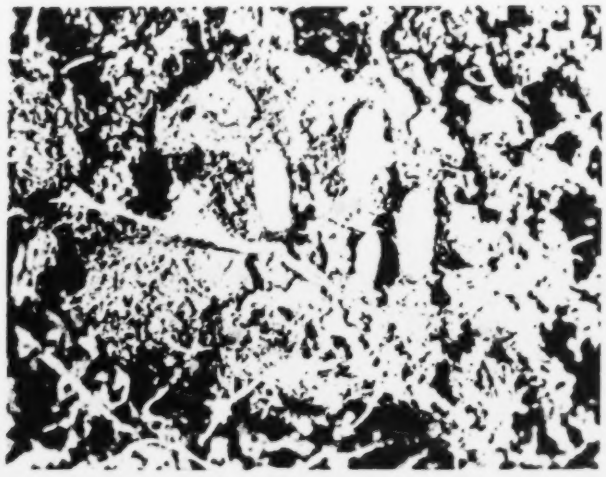


Figure 3. Root maggot pupae (about ¼ inch in length) in the soil.

Figure 4. Adult female root maggot fly.

Figure 5. Root maggot eggs are laid singly and in clusters at the base of the plant.

Both species have basically the same life cycle. The flies overwinter as pupae (Figure 3) in the soil at a depth of 1–6 inches. As the soil warms in the spring, the insects complete pupal development and emerge as adults (Figure 4). The adults emerge over a period of 4–8 weeks due to differences in the warming of the soil at different locations and depths. Adults begin to emerge from June 4 to June 19. They mate and lay eggs (Figure 5) at the bases of host plants at the soil surface, in cracks or under clods, or they may adhere to the plant stem. Egg laying begins 2–7 days after the flies begin to emerge. Early in the season the flies appear to have a preference for larger plants, usually faster growing varieties. More than 100 eggs can be laid on a single plant over a period of 2 days. Eggs hatch in 3–10 days. The tiny first stage larvae migrate down and tunnel into root tissue as they feed. In middle to late summer, when the larvae are mature (Figure 6) they move out of the root tissue and into the surrounding soil to pupate. Only one generation matures each year.

Figure 6. Root maggot larvae feeding on the root of a mustard plant.

Control

Several steps should be combined to provide the most complete protection against root maggots.

Crop rotation—Plant this year's root maggot host plants in ground that did not have host plants in it the previous year. The greater the separation between this

year's and last year's crucifer plantings the greater the effectiveness of this procedure. Crop rotation is often difficult in the home garden but a modest rotation and separation should be somewhat helpful.

Sanitation—This is a very important procedure that can be done easily by the home gardener. Do not abandon root maggot infested crops. They harbor countless numbers of insects which, if allowed to mature, will be the source of next year's infestation. If you have given up on a crop for any reason (root maggot infestation or weed competition, etc.), remove the crop and destroy it. As you harvest stem crucifers, remove the root system. This is especially important in earlier maturing varieties. Keep the garden and adjacent areas free of weedy mustards or other host plants.

Pesticides—Let the facts about root maggot biology and seasonal occurrence guide you as to when pesticides should be applied and where they should be directed.

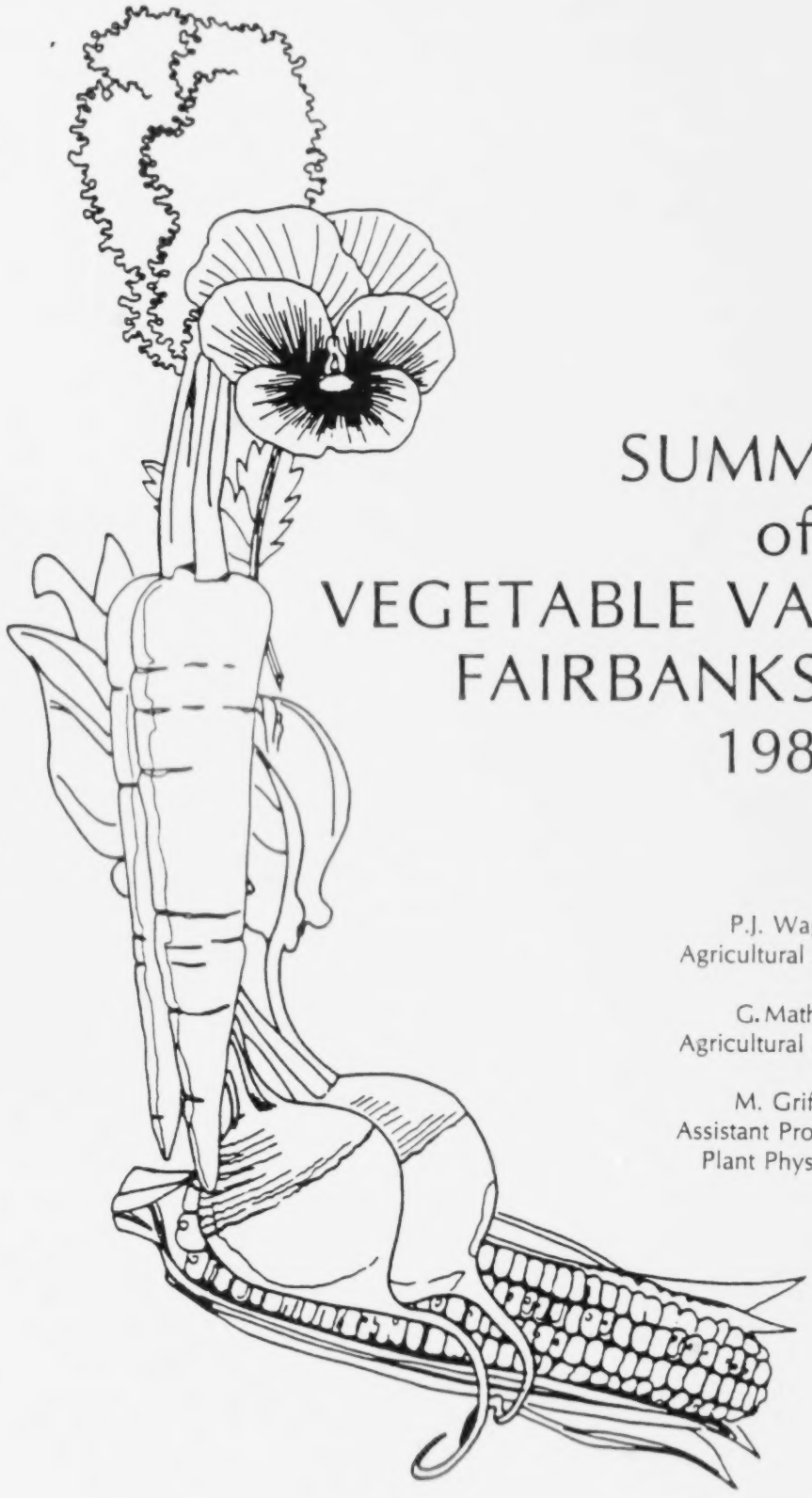
It has not been substantiated that soil incorporation of available insecticides provides complete control. This may be due to the ineffectiveness of the chemical at low soil temperatures. Currently, the insecticides labeled for use against the root maggot are Diazinon and newly registered insecticides—Lorsban and Dursban (chlorpyrifos). This compound is effective in controlling root maggots when applied as a spray to the bases of crucifer plants. A single, properly timed application may provide adequate control. Only one application may be made per season so timing is crucial for effective results. Read label instructions for rates and cautions and keep in mind the peculiarities of the life cycles of root maggots in Alaska.

A regular spray schedule should begin when the first egg is laid and should end when egg laying is complete (a period of 4–8 weeks). Insecticide sprays should be directed at the base of the plant where eggs are laid. It is not necessary to treat the leaves or the soil between rows. The target is not the egg stage, but the tiny, young larvae as soon as they hatch and before they move down into the soil. All other stages are less likely to be affected or even come into contact with the insecticide. Once the larvae are in the root and the signs and symptoms of infestation appear it is much too late to apply pesticides.

Diazinon must be reapplied every 7–10 days as long as the susceptible first stage larvae are present. **Do not apply Diazinon within 10 days of harvest. Lorsban and Dursban can only be applied once per season and you must wait 30 days before harvesting.**

To know when to begin and end your spray program, you must closely monitor your garden. Look at the base of several crucifer plants at regular intervals, preferably every day. Be sure to look at some of the larger, more mature plants. Look closely for the creamy, white, oblong eggs. They are about 1/16th inch long and are laid singly or in clusters of several at the base of the plant, on the soil, in cracks, and under clods. If you look closely they are quite conspicuous. Begin your spray program at the first sign of eggs in the garden. This may be anytime from June 12 through June 22. Eggs may be laid for a period of 4–8 weeks, and the spray program should continue throughout this period.

Any insect control strategy, including chemical, nonchemical, and home remedies, should be based on facts about the biology of the pest. Spend time in your garden and know exactly what is happening there. Become familiar with the biology and seasonal cycles of insect pests so that you can understand why some methods of control work and others do not. Use facts and common sense and plan ahead.



SUMMARY of VEGETABLE VARIETY TRIALS FAIRBANKS, ALASKA 1985

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SUMMARY OF VEGETABLE VARIETY TRIALS
FAIRBANKS, ALASKA, 1985

Introduction

This report summarizes evaluations of vegetable varieties conducted by the Horticultural Research Program of the University of Alaska-Fairbanks. The objective of this research is to select varieties of vegetables that are adapted to the environment of interior Alaska. Vegetable crops whose adaptability may be improved through development of improved cultural techniques are also identified. The selection effort is directed at finding varieties useful to both commercial growers and home gardeners. Varieties are chosen for inclusion in the variety tests on the basis of their description, the latitude of origin, and the record of the plant-breeding programs for producing kinds that have previously been found adapted. Standard recommended varieties are included in the trials for comparison.

The vegetable variety evaluation program has been responsible for a continuous improvement in yields, quality, and dependability for many vegetable crops grown in Alaska. Our philosophy is to depend upon the many existing plant-breeding programs, rather than investing in an expensive, on-site, plant-breeding effort. Progress can be made more rapidly by variety selection at this time.

Variety trials for cabbage, snapbeans and pickling cucumbers were not conducted in 1985 as the Horticultural Research Program began to implement a rotating schedule for testing of vegetable crops. All variety trials were conducted at the Agricultural and Forestry Experiment Station's research farm at Fairbanks.

The following tables show our results — including yields, maturity dates, and other useful characteristics and observations.

Weather Summary—1985

The 1985 growing season (see climate and weather data, Table 1 and Fig. 1.) began with a late snowmelt and cool temperatures, which resulted in planting dates up to 10 days later than usual for some crops. Temperatures remained below average in June, with precipitation above average so that crops grew slowly. Mid-July began a record-breaking sequence of 28 consecutive days with maximum temperatures 70 °F or above. Many crops matured rapidly during this period and, as a result, differences in maturation time for some varieties were condensed. August temperatures were 1.5 degrees below normal with measurable precipitation on 19 days. Production was delayed in crops which normally mature in mid- to late August, and the incidence of disease was high for many varieties. Although a hard frost did not occur until mid-September, harvest of peppers, tomatoes, eggplant, cucumbers, and summer squash was discontinued one week earlier due to poor fruit quality.

Table 1. Climatic Data for the Fairbanks Growing Season: 1984, 1985, and the Long-Term Average

	Average Temperature (°F)			
	Daily max.	Daily min.	Daily mean	Precip. (in.)
		May		
1985	58.7	33.4	46.1	0.45
1984	60.7	36.6	48.6	1.06
39-year average	60.2	33.7	46.9	0.75
		June		
1985	69.3	47.4	58.3	2.42
1984	74.3	48.6	61.4	0.85
39-year average	71.6	44.2	57.9	1.52
		July		
1985	73.7	49.8	61.8	1.08
1984	70.0	51.5	60.8	1.94
39-year average	72.6	47.2	59.9	2.12
		August		
1985	65.5	45.0	55.3	1.91
1984	64.1	43.9	54.0	1.30
39-year average	67.0	43.0	55.1	2.37
		September		
1985	50.9	35.3	43.1	3.10
1984	59.8	33.1	46.4	0.25
39-year average	55.3	33.6	44.6	1.42

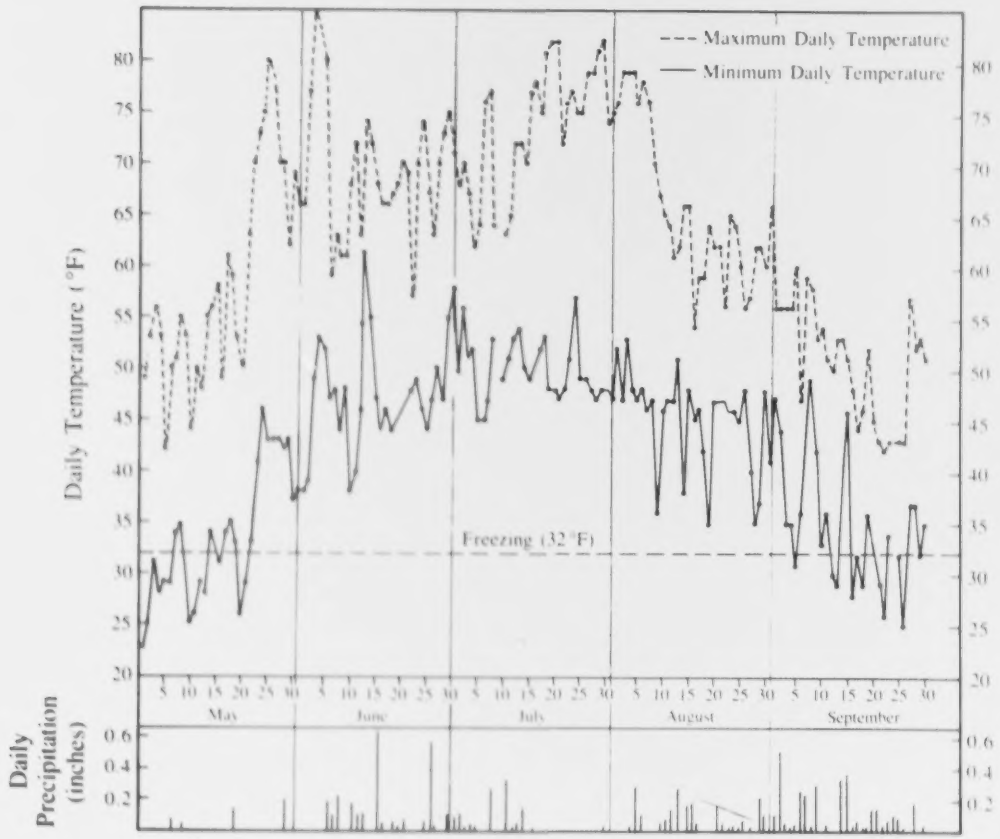

Figure 1. Daily weather data, May through September, 1985, University of Alaska-Fairbanks, Agricultural and Forestry Experiment Station.

Table 2. Artichoke Variety Trial, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	First harvest	Yield (gm/plant)	Yield (lb/100') terminals	Yield (lb/100') laterals	Comments
5067	Green Globe	Bu	2'	5'	8-5	163	18.0	27.5	good quality

[1] See seed source list.

Note: Greenhouse-grown plants, 48 days old, were transplanted into the field on June 5, 1985. Plants were grown through 1.5-mil clear polyethylene. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling. Trace elements (Peters Soluble Trace Element Mix) were applied at the rate of 2.5 oz/100 ft² on July 16, 1985.

Table 3. Carrot Variety Trials, Bottomland, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing row	Harvest date	Yield (lb/100')	Average wt. (gm)	Comments
6691	Royal Danvers	Ag	3'	9-11	292.9	130	consistent high yields
7318	Spartan Bonus	St	3'	9-11	287.5	66	
6771	Touchon Deluxe	St	3'	9-11	279.2	88	consistent high yields
7447	Royal Chantenay	Ag	3'	9-11	279.2	89	good flavor
7954	Scarlet Nantes	St	3'	9-11	250.0	101	good flavor
7710	Early Cross	Al	3'	9-11	250.0	106	

[1] See seed source list.

Note: Carrots were seeded May 30, 1985, with a Planet Jr. Seeder, using hole No. 7, and were not thinned. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling.

Table 4. Celery Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	First harvest	Yield (gm/plant)	Yield (lb/100')	Comments
6979	Green Giant	J	8"	18"	9-4	939	310.6	excellent flavor, consistent high yields
3802	Transgreen	FM	8"	18"	9-4	939	308.5	excellent flavor, consistent high yields
6787	Stokes Impr. Utah 52-70	St	8"	18"	9-4	924	305.6	good flavor
7257	Florida #683	G	8"	18"	9-4	923	305.1	good flavor

[1] See seed source list.

Note: Greenhouse-grown plants, 64 days old, were transplanted into the field on May 29, 1985. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling. One half pound of 20-20-20 (soluble)/100 ft² was applied on July 25, 1985.

Table 5. Eggplant Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	Harvest date	Yield (gm/plant)	Yield (lb/100')	Average wt. (gm)	Comments
3487	Dusky	A&C	16"	5'	8-9	366	60.6	77	oval shape, early and productive
7611	Satin Beauty	B	16"	5'	8-19	324	53.5	130	egg shape
7970	Epic	Tw	16"	5'	8-12	106	17.6	85	long teardrop shape
6094	Imperial	A&C	16"	5'	7-19	100	16.5	67	long slender fruit

[1] See seed source list.

Note: Greenhouse-grown plants 71 days old were transplanted into the field June 5, 1984. Plants were grown through 1.5 mil clear polyethylene and covered with clear polyethylene tunnel row covers until early July. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling. Trace elements (Peters Soluble Trace Element Mix) were applied at a rate of 2.5 oz/100 ft² on July 16, 1985. Eggplant is a very marginal crop in interior Alaska.

Table 6. Broccoli Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	First harvest	Peak cut date	Peak cut % cut	Yield (lb/100') terminals	Yield (lb/100') laterals	Average wt. (gm)	Comments
7878	Shogun	A&C	16"	3'	7-26	7-31	39	158.8	6.2	960	late, consistent high yields, large heads
8000	Green Valiant	J	16"	3'	7-22	7-24	54	99.0	42.6	599	midseason to late, consistent yields, nice laterals
6805	Emperor	NK	16"	3'	7-19	7-22	63	84.3	45.8	510	midseason, consistent high yields
7198	Green Duke	Tw	16"	3'	7-19	7-19	100	57.9	39.9	350	midseason, consistent high yields
7627	Laser	RS	16"	3'	7-17	7-19	49	53.2	32.2	322	
8044	Green Dwarf	P	12"	3'	7-5	7-22	73	49.6	32.9	225	nice compact heads, large laterals
7707	Packman	L	16"	3'	7-12	7-17	42	42.9	42.4	259	early, good quality
7949	Goliath	St	16"	3'	7-10	7-17	39	42.5	41.8	257	early, good quality

[1] See seed source list.

Note: Greenhouse-grown plants, 32 days old, were transplanted into the field on May 24, 1985. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling. Trace elements (Peters Soluble Trace Element Mix) were applied at the rate of 2.5 oz/100 ft² on June 24, 1985.

Table 7. Brussels Sprouts Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	First harvest	Yield (gm/plant)	Yield (lb/100')	Comments
7657	Early Crop	H	2'	3'	8-9	954	105.2	earliest, sprouts do not hold well
4064	Jade Cross E	NK	2'	3'	8-9	754	83.1	early
4424	Earli-Jade	A&C	2'	3'	8-9	646	71.2	early, good quality
5911	Prince Marvel	Tw	2'	3'	8-9	574	63.3	good quality

[1] See seed source list.

Note: Greenhouse-grown plants, 59 days old, were transplanted into the field on May 24, 1985. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling. Trace elements (Peters Soluble Trace Element Mix) were applied at the rate of 2.5 oz/100 ft² on June 24, 1985.

Table 8. Cauliflower Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	First harvest	Peak cut date	Peak cut % cut	Yield (lb/100')	Average wt. (gm)	Comments
6784	White Top	St	16"	3'	7-22	7-29	42	130.7	790	late, highest yield last three seasons
6978	Andes	J	16"	3'	7-29	7-29	54	128.0	774	late, consistent high yields
7325	White Rock	St	16"	3'	7-29	8-5	39	118.1	715	late
6980	White Fox	St	16"	3'	7-26	7-31	46	115.8	701	late, consistent high yields
7410	Formana	Se	16"	3'	7-24	7-29	35	114.0	690	late
7661	Snowball 123	H	16"	3'	7-19	7-29	86	95.8	580	mid-late
8002	Snowball 741	J	16"	3'	7-15	7-29	45	91.3	552	mid-late
6777	Delira	St	16"	3'	7-22	8-2	62	80.4	486	late
6778	Dominant	St	16"	3'	7-22	7-29	50	80.3	485	late
6639	Alpha Fortados	RS	16"	3'	7-17	7-19	42	60.1	363	early to midseason
7639	Alpha Paloma	RS	16"	3'	7-15	7-22	46	59.5	360	early to mid, best quality in early variety
7326	Alert	St	16"	3'	7-12	7-15	78	45.0	272	early, fuzzy curds
4976	Snow Crown	G	16"	3'	7-12	7-19	30	43.1	261	early
4591	Nevada	RZ	16"	3'	7-24	7-24	24	42.7	258	midseason
7644	Vernon	RS	16"	3'	—	—	—	—	—	no harvest, stunted by flooding

[1] See seed source list.

Note: Greenhouse-grown plants, 32 days old, were transplanted into the field on May 24, 1985. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling. Trace elements (Peters Soluble Trace Element Mix) were applied at the rate of 2.5 oz/100 ft² on June 24, 1985.

Table 9. Crisphead Lettuce Variety Trials, Bottomland, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	First harvest	Yield (lb/100')	Average wt. (gm)	Average core[2]	Average density[3]	Comments
7960	Ithaca	St	1'	3'	8-8	191.8	870	1.1	3.2	excellent flavor, most heads free from tipburn
8047	Mission	P	1'	3'	8-6	141.6	642	0.7	3.6	
6661	Montello	St	1'	3'	8-6	139.4	633	1.4	4.0	slight bitterness
7831	Malika	S&G	1'	3'	8-6	107.0	701	1.1	2.9	good flavor, 30% of heads not marketable, rot[4]
7827	Van Mor	H	1'	3'	8-14	102.1	1235	0.8	3.7	62% of heads not marketable, rot
7961	Minilake	St	1'	3'	8-6	81.4	789	0.6	3.2	good flavor, 36% of heads not marketable, rot
7395	Great Lakes WS	P	1'	3'	8-19	62.9	790	0.9	3.1	71% of heads not marketable, rot
7826	Sea Green	H	1'	3'	8-19	46.4	1053	1.0	1.7	66% of heads not marketable, rot
7824	Delmar	H	1'	3'	—	0	0	0	0	did not head

[1] See seed source list.
[2] Core length is noted from 1 to 5, with 1 being the shortest, most desirable, and 5 the longest.
[3] Density is noted from 1 to 5, with 1 the least dense and 5 the densest and most desirable.
[4] Fungal rot was promoted by cool, wet weather; it might have been reduced with use of appropriate fungicide.
Note: Lettuce was seeded by hand in bottomland plots on May 30, 1985. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling.

Table 10. Green Pea Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Plot size	First harvest	Yield[2] (gm/plot[3])	Yield[2] (lb/100')	shelled weight (% of weight) in shell	Comments
Shelled Peas								
7459	Mayfair	Ag	3' × 10'	8-5	11911	262.6	30.3	
7594	Lincoln	VB	3' × 10'	8-5	10379	228.8	31.7	good flavor
7979	Greater Progress	Tw	3' × 10'	7-31	9499	209.4	35.5	good flavor
7339	Novella	St	3' × 10'	8-2	9422	207.7	40.6	semileafless, easy to pick
7592	Almoto	VB	3' × 10'	8-5	9070	200.0	35.6	
8014	Olympia	Se	3' × 10'	7-29	8919	196.6	35.1	
5934	Green Arrow	Tw	3' × 10'	8-2	7738	170.6	33.1	good flavor
Snap Peas								
7963	Sugar Snap	St	3' × 10'	8-5	10234	225.6		
6135	Early Snap	Ag	3' × 10'	7-29	9491	209.2		
7421	Sugar Rae	J	3' × 10'	8-2	8590	189.4		
8048	Sugar Daddy	P	3' × 10'	8-2	5559	122.6		poor germination[4]
7596	Sugar Ann	VB	3' × 10'	7-26	3870	85.3		stringless pods, not as sweet poor germination[4]
Edible Podded Peas								
7598	Oregon Sugar Pod	VB	3' × 10'	7-29	6910	152.3		
7420	Snowflake	J	3' × 10'	7-29	4873	107.4		large pod size

[1] See seed source list.
[2] Weight including shell.
[3] Plot = 3' × 10' block with five evenly spaced rows.
[4] Seeded May 29, 1985, when wet soil conditions prevented seeder from operating correctly.
Note: Peas were seeded on May 30, 1985, except as noted. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling.

Table 11. Pepper Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	First harvest	Yield (gm/plant)	Yield (lb/100')	Average wt. (gm)	Comments
8008	Ringer	J	9''	5'	7-24	543	159.4	83	bell, new variety
7973	Hy Fry	Tw	9''	5'	7-19	413	121.2	51	sweet frying type, new variety
5737	Gypsy	AAS	9''	5'	7-22	400	117.5	53	yellow sweet, consistent high yields
6136	Italian Sweet	Ag	9''	5'	7-22	399	117.3	40	Italian sweet type
7971	Early Prolific	Tw	9''	5'	7-26	391	114.9	71	bell
7502	Eastern Rocket	V	9''	5'	7-29	371	109.0	45	yellow to red, mild to hot
7258	Early Bountiful	G	9''	5'	7-31	346	101.6	61	bell
7875	Golden Summer	A&C	9''	5'	8-21	323	94.8	129	yellow bell
7262	Early Thickset	P	9''	5'	7-22	323	94.8	67	bell
7877	Top Banana	A&C	9''	5'	7-29	288	84.5	22	yellow sweet
6042	Karlo	J	9''	5'	7-29	268	78.9	26	yellow semi-sweet Romanian type
7870	Jupiter	NK	9''	5'	7-22	253	74.4	61	bell
5564	Hot Portugal	H	9''	5'	7-19	202	59.3	21	hot to very hot, red
7211	Golden Bell	Tw	9''	5'	7-26	193	56.8	116	yellow bell
7210	Ma Belle	Tw	9''	5'	7-22	191	56.1	88	bell
7885	Blockbuster	PA	9''	5'	7-26	187	54.9	70	bell
5882	Hungarian Yellow Wax	NK	9''	5'	7-19	185	54.4	17	hot to very hot
7672	Super Shepherd	St	9''	5'	8-12	129	38.0	70	Italian sweet type
7876	Jalapa	A&C	9''	5'	8-7	98	28.9	12	mild to hot jalapeno type
7874	Bell Captain	A&C	9''	5'	7-22	97	28.4	97	bell

[1] See seed source list.

Note: Greenhouse-grown plants, 62 days old, were transplanted into the field on June 5, 1985. Plants were grown through 1.5 mil clear polyethylene and covered with clear-polyethylene tunnel row covers until early July. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling. Trace elements (Peters Soluble Trace Element Mix) were applied at a rate of 2.5 oz/100 ft^2 on July 16, 1985.

Table 12. Potato Variety Trials, Bottomland, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	First harvest	Yield U.S. #1 (lb/100')	Yield U.S. #1 (ton/acre)	Yield U.S. #2 (ton/acre)	%U.S. # 1	Comments
—	Green Mountain	AK	1'	3.3'	9-5	353	23.3	2.8	86.3	high quality baking potato
—	Butte	Gu	1'	3.3'	9-5	326	21.5	2.8	86.0	russet, first year in trials
—	Norland	F	1'	3.3'	9-5	323	21.3	4.1	81.2	red skin
—	Kennebec	Gu	1'	3.3'	9-5	323	21.3	2.2	89.1	seed not true to variety
—	Superior	F	1'	3.3'	9-5	287	18.9	2.0	90.0	early, should be harvested mid- to late August
—	83-13	D	1'	3.3'	9-5	287	18.9	1.8	90.1	
—	Bake King	AK	1'	3.3'	9-5	281	18.5	3.2	81.4	high-quality, good baking potato
—	Alaska Red	D	1'	3.3'	9-5	261	17.2	4.1	78.1	red skin
—	Norgold Russet	P&S	1'	3.3'	9-5	240	15.8	4.2	75.2	russet
—	Rote Erstling	AK	1'	3.3'	9-5	233	15.4	5.2	71.0	red skin, yellow flesh
—	Swedish	AK	1'	3.3'	9-5	204	13.5[2]	8.1[2]	—	yellow skin, buttery flavor
—	Alaska 114	AK	1'	3.3'	9-5	184	12.1	3.2	77.3	

[1] See seed source list.

[2] U.S. # 1 size standards not applied. 13.5 ton/acre ≥ 1½" diameter (short axis), 8.1 ton/acre < 1½" diameter.

Note: Potatoes were planted May 30, 1985, in bottomland soils which were amended in 1975 with 1000 yd³/A peat obtained from the College peat bogs. The pH of the amended soil was ca 5.5. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling.

Table 13. Cucumber (Slicing) Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	First harvest	Yield (gm/plant)	Yield (lb/100')	Average wt. (gm)	Comments
7062	Sweet Success	G	3'	5'	7-29	7500	550.6	317	consistent high yields, good flavor
7448	Slicemaster	Ag	3'	5'	8-5	4785	351.3	184	consistent high yields, good flavor
7020	Early Pride	Bu	3'	5'	8-5	4640	340.6	176	consistent high yields, good flavor
7958	Ultraslice	St	3'	5'	8-2	4235	310.9	182	
7500	Raider	V	3'	5'	8-5	4200	308.3	183	
7392	Euro-American	P	3'	5'	7-31	4118	302.3	229	spineless, good flavor
7675	Amira	T&T	3'	5'	8-2	1298	95.3	126	spineless
6896	Park's Commanche	P	3'	5'	8-5	1208	88.6	151	

[1]See seed source list.

Note: Greenhouse-grown plants 29 days old were transplanted into the field June 5, 1985. Plants were grown through 1.5-mil clear polyethylene. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling. Trace elements (Peters Soluble Trace Element Mix) were applied at a rate of 2.5 oz/100 ft² on July 16, 1985. Plants were covered with slitted plastic row covers from June 21 to July 8 because of cool, cloudy weather.

Table 14. Summer Squash Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	First harvest	Yield (gm/plant)	Yield (lb/100')	Average wt. (gm)	Comments
6205	Zucchini Elite	H	3'	5'	7-24	12285	901.9	424	zucchini, consistent high yields
7095	Green Magic	VB	3'	5'	7-17	10115	742.6	311	zucchini, tends to be stubby
7441	Buccaneer	J	3'	5'	7-26	8513	624.9	362	zucchini, consistent high yields
8015	Senator	Se	3'	5'	7-22	8285	608.2	353	zucchini, consistent high yields
5665	Gold Rush	Hb	3'	5'	7-26	6285	461.4	262	gold zucchini
7976	Goldbar	Tw	3'	5'	7-29	6085	446.7	277	yellow straight neck
7333	Greyzini	St	3'	5'	7-26	5625	412.9	256	zucchini
6669	Sundance	Tw	3'	5'	7-22	5428	398.4	190	yellow crook neck
6605	Seneca Prolific	NK	3'	5'	7-29	5275	387.3	185	yellow straight neck
5108	Smoothie	Tw	3'	5'	7-21	3908	286.9	230	yellow straight neck

[1] See seed source list.

Note: Greenhouse-grown plants 29 days old were transplanted into the field June 5, 1985. Plants were grown through 1.5-mil clear polyethylene. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling. Trace elements (Peters Soluble Trace Element Mix) were applied at a rate of 2.5 oz/100ft² on July 16, 1985. Plants were covered with a slitted plastic row cover from June 21 to July 8 because of cool, cloudy weather.

Table 15. Sweet Corn Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	First harvest	Days to harvest	Yield (gm/hill)	Yield (lb/100')	Average wt. (gm)	Comments
7340	Polar Vee	St	1'	5'	8-9	81	659.6	145.3	238	uniform ears, very early
7967	Earlivee	St	1'	5'	8-26	98	338.1	74.5	286	high quality, early
	Yukon Chief	AK	1'	5'	8-6	78	185.6	40.9	112	germination was very poor due to old seed
7819	MTD 484	EAK	1'	5'	9-13	116	182.3	40.2	304	
7966	Butter Vee	St	1'	5'	9-5	108	91.6	20.1	323	
7499	Morning Star	V	1'	5'	8-30	102	58.0	12.8	268	
6112	Sugar & Gold	F	1'	5'	9-13	116	44.1	10.0	221	
7817	MTD 481	EAK	1'	5'	9-5	108	43.0	9.5	322	
7133	Spring White	H	1'	5'	9-13	116	11.0	2.4	325	
7818	MTD 483	EAK	1'	5'	9-13	116	9.7	2.1	290	
7662	Blitz	H	1'	5'	—					no mature ears produced
8034	Classic Touch	V	1'	5'	—					no mature ears produced
7655	Early Golden	F	1'	5'	—					no mature ears produced
7656	Golden Beauty	F	1'	5'	—					no mature ears produced
5164	Golden Vee	St	1'	5'	—					no mature ears produced
7816	Marcross	Gu	1'	5'	—					no mature ears produced
7817	MTD 482	EAK	1'	5'	—					no mature ears produced
7820	MTD 485	EAK	1'	5'	—					no mature ears produced
7821	MTD 487	EAK	1'	5'	—					no mature ears produced
7822	MTD 488	EAK	1'	5'	—					no mature ears produced
7823	MTD 489	EAK	1'	5'	—					no mature ears produced
5427	Onthyb 741	Si	1'	5'	—					no mature ears produced
5424	Onthyb 804	Si	1'	5'	—					no mature ears produced
7412	Spring Crystal	Se	1'	5'	—					no mature ears produced

[1] See seed source list.

Note: Sweet corn was seeded on May 20, 1985, and covered with 1.5-mil clear polyethylene. After plants were approximately 4" tall, slits were made to allow plants to emerge from beneath the plastic. Fertilizer application was 1500 lb/A 10-20-20 prior to rototilling. 88 lb/A 25-10-10 (soluble) were applied July 3, 1985.

Table 16. Mulched Tomato Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	First harvest	Yield (gm/plant)	Yield (lb/100')	Average wt. (gm)	Comments
7834	Subarctic 25	JH	2.3'	5'	8-5	998	94.6	37	
7835	Alpha	JH	2.3'	5'	7-29	813	77.1	39	
7736	#18	NDS	2.3'	5'	8-9	692	65.6	35	consistent high yields
6013	Santa	NDS	2.3'	5'	7-26	688	65.3	36	consistent high yields
7760	#39	NDS	2.3'	5'	8-9	677	64.1	28	
7800	#73	NDS	2.3'	5'	8-16	557	52.8	45	
8080	Santiam	OSU	2.3'	5'	8-14	547	51.8	149	promising new variety
6995	Subarctic Plenty	J	2.3'	5'	8-2	483	45.8	35	
7748	#24	NDS	2.3'	5'	8-12	483	45.8	34	
8012	Gem State	J	2.3'	5'	7-29	480	45.5	25	
7833	Superarctic F_2	JH	2.3'	5'	8-12	437	41.4	60	
6045	Sprint	J	2.3'	5'	8-5	432	40.9	37	
7759	#38	NDS	2.3'	5'	8-12	328	31.1	38	
7722	#4	NDS	2.3'	5'	8-12	298	28.3	31	
7792	#68	NDS	2.3'	5'	8-12	270	25.6	28	
8040	Siberia	Sib	2.3'	5'	8-5	230	21.8	53	
5503	Bonner	M	2.3'	5'	8-12	217	20.5	41	
5502	Latah	M	2.3'	5'	8-5	207	19.6	34	
7073	Early Temptation	V	2.3'	5'	8-7	147	13.9	40	
8039	Glacier	Sib	2.3'	5'	8-7	143	13.6	48	
5501	Shoshone	M	2.3'	5'	8-2	110	10.4	19	
7784	#63	NDS	2.3'	5'	8-23	97	9.2	48	
8079	Oregon Spring	OSU	2.3'	5'	8-30	67	6.3	200	

[1] See seed source list.

Note: Greenhouse-grown plants 48 days old were transplanted into the field June 5, 1985. Plants were grown through 1.5-mil clear polyethylene and covered with clear polyethylene tunnel row covers until early July. Fertilized application was 1500 lb/A 10-20-20 prior to rototilling. Trace elements (Peters Soluble Trace Element Mix) were applied at the rate of 2.5 oz/100ft² on July 16, 1985. Weather conditions promoted vegetative growth, consequently, fruit production began very late.

Table 17. Unmulched Tomato Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	First harvest	Yield (gm/plant)	Yield (lb/100')	Average wt. (gm)	Yield prior to 8-29 (lb/100')	Yield prior to 8-29 rank	Early yield prior to 8-12 (lb/100')	Early yield prior to 8-12 rank	Comments
7834	Subarctic 25	JH	2.3'	3'	7-15	1350	127.9	27	118.3	1	34.5	1	Cool wet conditions in August resulted in a high percentage of cracked fruit for all varieties.
7833	Superarctic F_2	JH	2.3'	3'	7-22	1255	118.9	60	102.0	3	31.1	4	
7835	Alpha	JH	2.3'	3'	7-15	1159	109.9	41	106.7	2	32.5	3	
8040	Siberia	Sib	2.3'	3'	7-19	1127	106.8	65	101.3	4	34.4	2	
7800	#73	NDS	2.3'	3'	7-17	1045	99.1	34	81.4	5	30.2	5	
8039	Glacier	Sib	2.3'	3'	7-22	897	85.1	55	76.5	7	22.5	7	
7722	#4	NDS	2.3'	3'	7-15	850	80.5	30	80.5	6	24.2	6	

[1] See seed source list.

Note: Greenhouse-grown plants 56 days old were transplanted into the field June 6, 1985. Fertilized application was 1500 lb/A 10-20-20 prior to rototilling. Excess foliage and blossoms were pruned at the end of July.

Table 18. Container Tomato Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	First harvest	Yield (gm/plant)	Average wt. (gm)	Comments
8049	Goldie	P	7-15	2102	25	small fruited gold tomato
6222	Basket King	Bu	7-1	1989	31	consistent high yields
4778	Pixie	G	7-12	1742	42	consistent high yields
8050	Better Bush	P	7-31	1398	175	
6698	Toy Boy	Ag	7-12	1387	30	excellent flavor

[1] See seed source list.

Note: Greenhouse-grown plants were seeded March 26, 1985 (Goldie & Better Bush were seeded April 2, 1985 due to late arrival of seed) and transplanted into 8½'' x 8½'' No. 2 nursery containers on May 3, 1985. 30 gms of 14-14-14 Osmocote® was placed in the container at transplanting. Plants were held in the greenhouse until May 28, 1985. Plants were fertilized weekly with 20-20-20 soluble fertilizer applied at a rate of 1 tablespoon per gallon of water.

Table 19. Winter Squash Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	Harvest date	Yield (kg/plant)	Yield (lb/100')	Average wt. (kg)	Comments
7964	Hungarian Mammoth	St	8'	8'	9-4	49	1362.5	16	green, large fruits
7334	Baby Hubbard	St	8'	8'	9-4	19	533.3	3	orange hubbard
6611	Sweet Meat	NK	8'	8'	9-4	18	496.9	5	blue-green, good flavor
5178	Sweet Mama	St	8'	8'	9-4	16	443.7	2	dark green, buttercup type, high quality
7977	Green Hubbard	Tw	8'	8'	9-4	14	390.6	6	
5180	Golden Hubbard	St	8'	8'	9-4	9	246.9	3	orange hubbard, good quality
5894	Pink Banana	NK	8'	8'	9-4	8	209.4	4	pink/orange, large fruits, usually has higher yields
7455	Buttercup	Ag	8'	8'	9-4	4	100.0	1	turk's turban, dark green, high quality

[1] See seed source list.

Note: Greenhouse grown plants 34 days old were transplanted into the field June 5, 1985. Plants were grown through 1.5-mil clear polyethylene. Fertilizer application was 1500 lb/A 10-20-2 prior to rototilling. Trace elements (Peters Soluble Trace Element Mix) were applied at a rate of 2.5oz/100ft² on July 16, 1985. Plants were covered with slitted plastic row covers from Jun 21 to July 8 because of cool, cloudy weather.

Table 20. Pumpkin Variety Trials, 1985.

A.F.E.S. Accession No.	Variety	Source[1]	Spacing plant	Spacing row	Harvest date	Yield (kg/plant)	Yield (lb/100')	Average wt. (kg)	Comments
5970	Connecticut Field	St	8'	8'	9-4	39	1078.1	9	consistent high yields
7668	Pankow's Field	H	8'	8'	9-4	34	937.5	8	
6043	New England Pie	J	8'	8'	9-4	18	500.0	2	small fruit, for home use
4307	Little Boo	Ag	8'	8'	9-4	16	431.3	4	white skin, painting pumpkin
7215	Funny Face	Tw	8'	8'	9-4	15	409.4	4	

[1] See seed source list.

Note: Greenhouse-grown plants 34 days old were transplanted into the field June 5, 1985. Plants were grown through 1.5-mil clear polyethylene. Fertilizer application was 1500 lb/A 10-20-2 prior to rototilling. Trace elements (Peters Soluble Trace Element Mix) were applied at a rate of 2.5 oz/100 ft² on July 26, 1985. Plants were covered with a slitted plastic row cover from Jun 21 to July 8 because of cool, cloudy weather.

The following vegetables were rated excellent (E), very good (VG), good (G), satisfactory (S), fair (F), or poor (P) in overall performance. These evaluations were subjective, based on growth, productivity, and general quality.

Table 21: Miscellaneous Vegetable Trials

Crop		Source	Rating	Comments
Beets				
No. 7197	Pacemaker III	Tw	VG	round shape
No. 6088	Sangria	A&C	G	globe shape
No. 7669	Forono	Da	VG	long shape, straight
No. 7952	Formanova	St	VG	long shape
No. 7317	Little Egypt	St	VG	early, flat shape, uniform
No. 7067	Little Ball	V	G	early, top-shaped
Chinese Vegetables - Cabbage				
No. 6893	Jade Pagoda	P	P	bolted
No. 7969	What-a-Joy	Tw	P	bolted
No. 8001	W-R Green 60	J	P	bolted
Chinese Vegetables - Daikon (Radish)				
No. 4391	Tokinashi	J	G	holds well, root maggot control essential
No. 8010	Summer Cross #3	J	P	bolted
Dill				
No. 7507	Bouquet	V	G	
No. 4313	Dukat	Ag	G	tallest variety
No. 3297	Tuve	Ag	G	
Greens				
No. 7959	Green Curled Scotch Kale	St	G	
No. 8003	Winterbor Kale	J	F	poor germination
No. 6949	Green Lance Chinese Kale	WD	S	stalks, young leaves & buds are all edible
No. 8033	Green Smooth Leaf Chard	WD	VG	slowest to bolt
No. 7327	White King Chard	St	G	large size
No. 7432	Rhubarb Chard	J	S	crimson stalks, bolts readily
Herbs				
No. 6383	Basil, Green Bouquet	Bu	G	small leaf, less compact than Spicy Globe
No. 7408	Basil, Italian	P	S	
No. 3822	Basil, Lettuce Leaf	P	S	large, crinkled leaf
No. 8043	Basil, Minimum	P	S	
No. 8042	Basil, Picollo	P	G	small leaf, larger size plant
No. 7869	Basil, Spicy Globe	NK	VG	small leaf, very compact, uniform
No. 2052	Catnip	NK	VG	
No. 6620	Chervil, Curled	NK	VG	
No. 6983	Chinese Leek (Chives)	J	G	garlic scent
No. 7682	Chives	Ap	VG	
No. 7130	Fennel, Mammoth	H	S	good foliage, did not bulb at base
No. 8031	Lemon Balm	WD	VG	fragrant
No. 7065	Mint, Curled	G	VG	
No. 7261	Oregano	G	F	weak growth
No. 6984	Pennyroyal	J	VG	
No. 6004	Peppermint	G	VG	
No. 8046	Rue	P	S	decorative
No. 6987	Rosemary	J	G	

Table 21, continued

Crop		Source	Rating	Comments
Herbs, continued				
No. 7506	Sage	V	VG	
No. 7908	Sorrel	GM	VG	direct seed, good sour flavor
No. 6986	Spearmint	J	VG	
No. 6623	Summer Savory	NK	VG	
No. 6624	Sweet Marjoram	NK	VG	
No. 6625	Thyme, English	NK	VG	
No. 5664	Thyme, French Narrow Leaf	Hb	VG	slightly milder than English
Kohlrabi				
No. 3340	Prima	Bu	VG	early
No. 6673	Grand Duke	AAS	VG	early
No. 7434	Karla	J	G	
No. 7591	Purple Delicacy	VB	S	late
Leeks				
No. 7205	Leader	Tw	E	yielded 179 lb/100 ft, av. wt. 211 g
No. 4388	King Richard	J	VG	yielded 147 lb/100ft, av. wt. 182 g
Lettuce, Bibb				
No. 6643	Rigoletto	RS	G	matures later, buttery flavor
No. 6989	Kagran Summer	J	G	no tipburn
No. 8004	Patty	J	S	attractive, slight tipburn
No. 7068	Dolly	V	S	attractive, slight tipburn
No. 7645	Oresto	RS	S	grown as transplant, some tipburn
Lettuce, Leaf				
No. 6810	Prizehead	Al	E	red-tipped, buttery flavor, holds well
No. 6594	Ruby	NK	VG	reliable, red-leaved, holds well
No. 6595	Salad Bowl	NK	VG	reliable, standard green-leaved variety
No. 5874	Oak Leaf	NK	VG	attractive cut leaves
No. 7837	Red Sails	AAS	S	red-leaved
No. 8032	Dunsel	WD	P	bolted
Lettuce, Romaine				
No. 6990	Winter Density	J	VG	small heads, excellent flavor
No. 6591	Parris Island	Al	G	large size
No. 7711	Valmaine	NK	G	large size
Onions, Dry (transplants)				
No. 7328	Gringo	St	F	formed a few large bulbs
No. 7451	Sweet Spanish	Ag	F	formed a few large bulbs
No. 7676	Riverside Strain	T&T	P	formed a few bulbs, small size
No. 7329	Riverside Sweet Spanish	J	P	formed a few bulbs, small size
No. 4221	Spano	P	P	formed few bulbs, small size
No. 8007	Copra	J	P	no bulbs formed
No. 8006	Ringmaker	J	P	no bulbs formed
No. 7962	Tarmagon	St	P	no bulbs formed

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Table 21, continued

Crop		Source	Rating	Comments
Herbs, continued				
Onions, Bunching & Pickling (direct seed)				
No. 7547	Crystal Wax Pickling	Bu	F	damaged by root maggots
No. 6794	Hardy White	St	F	damaged by root maggots
No. 7208	Evergreen White	Tw	P	very poor germination
Parsley				
No. 7405	Curlina	P	E	very uniform, fine leaved
No. 3480	Decorator	A&C	E	tightly curled leaves, mild flavor
No. 5088	Delikat Original	J	E	compact, tightly curled leaves
No. 6621	Hardy Italian	NK	E	flat leaf, excellent flavor
No. 5013	Improved Market Gardeners	Tw	E	open leaved, fairly strong flavor
No. 6897	Paramount	P	E	open leaved
No. 7439	Forest Green	J	VG	leaves variable, stronger flavor
Radishes				
No. 5883	Cherry Belle	NK	G	best red
No. 7975	Snowbelle	Tw	G	best white
No. 8009	Ribella	J	S	
No. 5106	Inca	Tw	F	unattractive shape
No. 3343	All Seasons White	Bu	F	matures later, root maggot control a problem
7132	Fancy Red	H	P	bolted
Rutabaga				
No. 3217	Altasweet	Pi	G	
No. 7067	York	V	G	
No. 8011	Pike	J	F	small size, irregular shape
Spinach				
No. 5176	Melody	St	G	holds well
No. 7504	Popeye's Choice	V	G	holds well, less savoyed
Turnip				
No. 7978	Royal Globe II	Tw	G	holds well, less root maggot damage
No. 4380	Tokyo Top	J&P	S	

Seed Sources

AAS	All-America Selections, 4546 El Camino Real, Suite A, Los Altos, CA 94022
A&C	Abbot and Cobb, Inc., P.O. Box 307, Feasterville, PA 19124
Ag	Agway, Inc., Seed Division, Box 4933, Syracuse, NY 13221
AK	Agriculture and Forestry Experiment Station, University of Alaska-Fairbanks, Fairbanks, AK 99775-0080
Al	Alberta Nurseries & Seeds Ltd., Box 20, Bowden, Alberta T0M 0K0, Canada
Ap	Applewood Seed Co., P.O. Box 4000, Golden, CO 80401
B	Geo. Ball Pacific, Inc., Box 9055, Sunnyvale, CA 94088
Bu	W. Atlee Burpee Co., 6350 Rutland Ave., Box 748, Riverside, CA 92502
D	Dearborn Farms, SR A, Box 6124, Palmer, AK 99645
Da	Daehnfeldt, P.O. Box 947, Albany, OR 97321
EAK	Dr. E.A. Kerr, Stokes Seeds Ltd., 39 James St., P.O. Box 10, St. Catherines, Ontario, L2R 6R6 Canada
F	Farmer Seed & Nursery Co., Faribault, MN 55021
FM	Ferry-Morse Seed Co., P.O. Box 100, Mountain View, CA 94042
G	H.G. German Seeds, Inc., Box N, Smethport, PA 16749
GM	Garden Magic Seed Co., 310 Main St., East Haven, CT 06512
Gu	Gurney Seed and Nursery Co., Yankton, SD 57079
H	Harris Moran Seed Co., 1155 Harkins Rd., Salinas, CA 93901
Hb	Herbst Brothers Seedsmen, Inc., 1000 N. Main St., Brewster, NY 10509
J	Johnny's Selected Seeds, Albion, ME 04910
J&P	Jackson & Perkins Co., Medford, OR 97501
JH	John Holm, Arctic Landscape Contractors, P.O. Box 196, Fairbanks, AK 99707
L	Letherman Seed Co., 1221 Tuscarawas St. E., Canton, OH 44707
M	Mountain Seed & Nursery, Box 271, Rt. 1, Moscow, ID 83843
NDS	A.A. Boe, Chairman, Dept. of Horticulture & Forestry, North Dakota State U., Fargo ND 58105
NK	Northrup King & Co., 1500 Jackson St., N.E., Minneapolis, MN 55413
OSU	Dr. J.R. Baggett, Horticulture Dept., Oregon State University, Corvallis, OR 97331
P	George W. Park Seed Co., Box 31, Greenwood, SC 29647
PA	Pan American Seed Co., P.O. Box 438, West Chicago, IL 60185
Pi	Pike and Co., Ltd., 10552-114 St., Edmonton, Alberta T5H 3J7 Canada
P&S	Pay 'n Save Stores, Fairbanks, AK
RS	Royal Sluis, Inc., 1293 Harking Rd., Salinas, CA 93907
RZ	Rijk Zwaan Zaadteet en Zaadhandel B.V. Burgem. Crezeelaan 40 DeLier (Holland) Postbus 40, 2678 ZG DeLier, The Netherlands
Se	Seedway, Inc., Hall, NY 14463
S&G	Sluis & Groot of America, 124A Griffin St., Salinas, CA 93907
Si	Horticultural Experiment Station, Box 587, Simcoe, Ontario N3Y 4N5, Canada
Sib	Siberia Seeds, P.O. Box 3000, Olds, Alberta T0M 1P0, Canada
St	Stokes Seeds, Inc., 5008 Stokes Bldg., Buffalo, NY 14240
T&T	T&T Seeds, Ltd., Box 1710, Winnipeg, Manitoba R3C 3P6, Canada
Tw	Otis S. Twilley Seed Co., Inc., P.O. Box 65, Trevose, PA 19047
V	Vesey's Seeds, Ltd., York, Prince Edward Is. C0A 1P0, Canada
VB	Vermont Bean Seed Co., Garden Lane, Bomoseen, VT 05732
WD	William Dam Seeds, P.O. West Flamboro, Ontario L0R 2K0, Canada

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